STATE OF UTAH

NONPOINT SOURCE MANAGEMENT PLAN FOR HYDROLOGIC MODIFICATIONS

an addendum to the:

UTAH NONPOINT SOURCE MANAGEMENT PLAN

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INTRODUCTION

Utah's people rely substantially upon Utah's water resources. With the development and use of these resources, *significant changes to the hydrologic function (dynamics) or attendant pollutant release regime of rivers (and streams) and riverine systems, lakes and impoundments, and ground water systems* can occur. These changes are called hydrologic modifications (hydromod). This Hydromod Plan is an addendum to the Utah NPS (nonpoint sources of water pollution) Management Plan. It identifies Utah's approach to preserving water quality and other water resource benefits, including related aquatic wildlife habitat, during hydrologic modifications. The same approach is used to reverse water quality degradation occurring from hydrologic modifications of the past.

Plan Intent:

The intent of this document is **not** to establish a framework for regulating water pollution from hydrologic modifications. There is an existing framework of regulations in Utah that support water quality objectives. Instead, the intent is more open-minded. It is to identify how colleagues or "stakeholders" can work together to improve water quality protection during hydrologic modifications and to achieve water quality improvements from previous modifications. Regulations and statutory requirements are one set of tools that stakeholders can use. If by working together, it is found that regulations can be improved, this approach supports that improvement.

But there are other ways to protect and improve water quality. These methods are often called the incentive-based or voluntary approach. This terminology is inadequate. Incentives are too often thought of as simple monetary incentives. Monetary incentives are useful much like the well-known "carrot" in the "carrot and stick" approach. But incentives can take other forms. Some satisfy either a property owner's objective for strictly monetary gain or for other purely personal objectives. These incentives can be described as follows:

- short-term monetary gains or gains in convenience that are achieved by implementing Best Management Practices (BMPs) - "the bottom line is important" - the free market system most effectively supports these incentives;

- long-term monetary gains or gains in convenience that are achieved by implementing the BMPs - "if you take care of the land, it will take care of you" - the property ownership ethic in association with the free market system most effectively supports these incentives;

- long-term (non-monetary) resource protection objectives on the property that are achieved by implementing the BMPs - "I like my land to look nice" - these incentives are realized when property owners espouse objectives that are not monetarily driven; and,

- benevolence or goodwill - the property owner decides to implement the BMPs "because it's the right thing to do" - the stewardship ethic most effectively supports these incentives.

These four types of incentives ideally would always be realized without governmental intervention. But there are several reasons or barriers to why they don't automatically occur: They include social and cultural resistance, economic risk, technologic complexity, evolving and diverse perceptions of environmental functions and values, and competing objectives.

Methods to overcome these barriers can generally be categorized into six strategies:

- Initiative and Innovation - fosters competitiveness and improvements in natural resource management in a dynamic and socioeconomically complex world. Examples of this strategy include research sponsored by educational institutions, research and development supported by private corporations, as well as experimentation by individuals;

- Coordinated Resource Management - provides a method to establish consensual objectives and to implement supporting activities. Examples of this strategy include interdisciplinary teams (IDT) of the USDA Forest Service and the Coordinated Resource Management Planning (CRMP) process of E. William Anderson;

- Information/Education - informs property owners and land managers of the evolving and diverse perceptions of environmental functions and values as well as technological updates;

- Technical Assistance - addresses the technological complexity of natural resource management;

- Financial Incentives - reduce the economic risk of untried technology and support objectives that society values but the property owner may not value or is financially unable to support; and,

- Regulation - imposes restrictions on property owners in order to prevent activities that society definitely determines are wrong.

This Hydromod Plan provides "an identification of the best management practices and measures which will be undertaken to reduce pollutant loadings resulting from (the hydrologic modification category of nonpoint sources), taking into account the impact of the practice(s) on ground water quality" (language which specifies the contents of each state's management program in §319 of the Clean Water Act). Because the treatment of nonpoint source pollution is still an inexact science, there remains significant leeway in what can be identified as "best." Also, what is "best" varies from site to site. Stakeholders or people who have a stake in what occurs at a site must get together, understand the problem, and mutually agree upon objectives. They then must work together to agree on which measures or courses of action will best achieve the objectives for the particular site (the coordinated resource management strategy). This includes the appropriate consideration of the needs of property (landowners and water rights) owners as well as of water quality and related aquatic wildlife habitat.

This document encourages a full exploration of opportunities for protecting and improving water quality and related aquatic wildlife habitat during hydrologic modifications. Regulatory requirements become the minimum standard. Utah fully supports efforts to explore each of the six strategies identified above. The intent is to surpass what regulations alone would provide. This enables stakeholders to fully consider the cost effectiveness and efficiency of each alternate method in reaching the water quality and other resource management objectives. The approach also provides opportunity to reduce the costly method of strictly regulatory approaches, not only in financial resources, but also in restrictions to initiative, innovation, and in the opinion of many, our liberties.

Hydromod Plan (addendum) overview:

This Hydromod Plan first describes the various types of hydrologic modification which can generate nonpoint source (NPS) water pollution (and impacts to related aquatic wildlife habitat). These descriptions are fairly extensive and show a wide variety of land uses that can generate hydrologic modifications.

The next section identifies what is known about the extent of the problems in Utah. According to the State of Utah - Water Quality Assessment for 1992 [§305(b) Report], hydrologic modification accounts for major water quality impact to 181 miles and 99,588 (Utah Lake accounts for 96,900) acres of Utah's waterbodies. This section also identifies Utah's priority NPS watersheds. These watersheds have been prioritized by the Utah NPS Task Force for implementation of NPS pollution control activities (without regard to §319 of the Clean Water Act). This prioritization is for all NPS pollutant categories (hydrologic modification, agriculture, urban, mining, silviculture, construction, etc.). An implementation schedule is provided. With the approval of this Hydromod Plan by the EPA (Environmental Protection Agency), Utah's Hydromod BMPs (Best Management Practices) can be funded by the NPS Task Force using §319 BMP implementation funding.

The Hydromod Plan then describes the strategy Utah is pursuing to accomplish NPS pollution control from hydrologic modification pollution sources (and impacts to related aquatic wildlife habitat). This strategy begins with the strong reliance Utah has for the principles of Coordinated Resource Management Planning. This process is identified in the Utah Coordinated Resource Management and Planning Handbook and Guidelines. Most agencies involved in NPS

pollution control recognize the value of these principles. In 1988, a Memorandum of Understanding for Coordinated Resource Management between six federal and four state agencies was signed whereby the agencies formally subscribed to these principles.

Using these principles, the Utah NPS Task Force was formed. In order to develop BMPs to specifically address water quality impacts from hydrologic modifications and to perform related tasks, the Task Force formed the Hydromod Subcommittee. The Hydromod Plan describes the ongoing responsibilities of this group. This group has several roles. They advise the Utah NPS Task Force of appropriate BMPs and suggest improvements to the NPS Management Plan regarding hydrologic modifications. They also coordinate with other groups around the state that have differing goals and objectives but may benefit from Utah's Hydromod BMPs (i.e., Utah water plan, CUP - Central Utah Project fisheries mitigation, Utah river enhancement, Colorado River salinity control, etc.). The Hydromod Plan also describes the lead role of the Utah Division of Water Quality as well as the participation of coordinating agencies. The Division's use of the Utah Department of Agriculture and the Utah Association of Conservation District programs to deliver the agricultural portion of the NPS program is one good example. The support from agencies such as the Utah Department of Natural Resources, the USDA Soil Conservation Service, Utah State University Cooperative Extension is also vital. Milestones for updating the Hydromod Plan and for implementing Utah's Hydromod BMPs (first in the short list of five high priority NPS watersheds) are then referenced. A description of how programs address each implementation strategy is also included.

A description of the existing regulatory framework that Utah has for hydrologic modifications follows. This framework serves as a minimum standard. Neither the Hydromod Plan, the Hydromod Planning Process, nor any of the Utah Hydromod BMPs stand in lieu of the regulatory requirements of other governmental agencies.

The Hydromod Plan ends by describing Best Management Practices (BMPs) used to treat water pollution problems arising from hydrologic modification activities. Utah's Hydromod BMPs have been adopted by the state via the NPS Task Force. They specify application standards for implementing BMPs. The Utah NPS Task Force will support site specific measures or BMPs as treating hydrologic modification NPS pollution only when they satisfy the application standards in the Utah Hydromod BMP for that activity and in the Hydromod Planning Process.

TYPES OF HYDROLOGIC MODIFICATION

Hydrologic modification occurs *whenever human activities significantly change the hydrologic function (dynamics) or the attendant pollutant release regime of rivers (and streams) and riverine systems, lakes and impoundments, and ground water systems*. These modifications can create nonpoint source (NPS) water pollution (and impacts to related aquatic wildlife habitat). However, it is important to recognize that these modifications are sometimes used to ameliorate NPS pollution.

This definition is extremely broad. It includes a variety of activities including two references to hydrologic modification identified in Section 304(f)(2) of the Federal Clean Water Act (CWA):

> (E) salt water intrusion resulting from reductions of fresh water flow from any cause, including extraction of ground water, irrigation, obstruction, and diversion; and
>
> (F) changes in the movement, flow, or circulation of any navigable waters or ground waters, including changes caused by the construction of dams, levees, channel, causeways, or flow diversion facilities.

Section 319 (a)(1)(B) of the Clean Water Act directs that States prepare a State Assessment Report that "identifies those categories and subcategories of nonpoint sources or, where appropriate, particular nonpoint sources which add significant pollution to each portion of the navigable waters . . . " The State of Utah - Water Quality Assessment for 1992 [Section 305(b) Report] identifies several NPS water pollution cause categories that are hydrologic modifications as defined above. They include Hydrologic / Habitat Modification, Channelization, Dam Construction, Flow Regulation, Draining / Filling Wetlands, and Upstream Impoundment.

Hydrologic modification activities can generally be classified into two types:

1. Activities that alter the flow regime of a body of water:
    a. streams (including activities such as diversions, trans-basin diversions, or activities that occur on the watershed, like clear-cutting or urbanization);
    b. lakes and reservoirs (including activities that effect storage capacity or circulation patterns, or that release stored pollutants); and
    c. ground water including shallow aquifers (including pumping, injection, and activities that move or affect ground water recharge areas).
2. Near-stream or instream activities that alter the function or stability of a stream channel or the floodplain.

When hydrologic modifications generate water pollution and are not regulated as point sources, they are nonpoint source pollution. This includes the destruction of aquatic habitat characteristics that support and protect water quality, these are an integral part of water quality. An outline of hydrologic modification activities is attached in Appendix B. Please note: This Hydromod Plan is written to address NPS pollution from human induced hydrologic modifications. But the elements in this Hydromod Plan may be useful in addressing water quality and related aquatic wildlife habitat problems arising from "natural" hydrologic modifications (such as landslides). It may also be useful in addressing hydrologic modifications that have been or may eventually be regulated as point sources.

Streamflow regime:

Activities that alter the flow regime of a stream are numerous and can be obscure. The more obvious include trans-basin diversions (such as sustained high flows or flows that greatly exceeds the geomorphic capacity of a stream or its valley), reservoir release regime, and diversions (including dewatering).

Less obvious modifications to flow regimes come from watershed activities. These include forest harvest, fire, brush removal, land disturbance, urbanization, mining, and other land use activities. On-site NPS pollution from these activities is addressed in the other components of the Utah NPS Management Plan. This Hydromod Plan addresses those activities that together generate a hydrologic modification and resulting water pollution or impacts to related aquatic wildlife habitat. Brush removal or other types of large scale vegetation removal often alter the hydrologic regime downstream with higher runoff peaks and shorter duration flows. However, there are significant cases where brush removal provides an improved hydrologic regime downstream. With urbanization, pavement typically impedes percolation and soil storage of rainfall plus storm drainage systems increase water delivery efficiency - also drastic changes in vegetation type and concentration can occur.

Lake and reservoir circulation regime:

Activities that alter the flow regime of lakes and reservoirs include dredging to increase storage capacity, the construction of dikes and levies that affect changes to circulation patterns in the reservoir, and diversion or reservoir sluicing where operators allow water to flush through and clean a diversion or reservoir. Sediment and nutrient loads may be re-suspended in high concentrations and wasted back to the river.

Ground water flow:

Pumping and recharge are clearly activities that modify the hydrologic function and dynamics of ground water systems. Other activities, usually located on the land surface can also modify ground water systems, especially shallow aquifers. All of the activities that modify stream regime and stream stability can similarly affect ground water flow. Additional activities include drainage activities, wetland reclamation and construction, and deep soil irrigation.

Stream channel and floodplain function and stability:

Near-stream or instream activities can alter the function or stability of a stream. Some of these activities are obvious hydrologic modifications. These include the construction of structures within or directly along the stream channel (diversions, bridge abutments, dams, channel straightening, utility crossings, stream stabilization) and dredging, fill disposal, and significant disturbances to stream-side vegetation. In Utah, most of these activities are regulated by the Utah Division of Water Rights and the U.S. Army Corps of Engineers.

Less obvious near-stream activities may also alter the function or stability of a stream. Wetland restoration or construction in streamside areas, floodplain modification activities, and riparian vegetation manipulation such as grazing or noxious weed control in riparian areas are examples. These hydrologic modifications change stream function by changing the infiltration dynamics of the riparian and floodplain areas and by changing flood dynamics (hydrographs). Again, on-site NPS pollution from these activities is addressed in the other components of the Utah NPS Management Plan. However, this Hydromod Plan addresses those activities that together generate a hydrologic modification and resulting water pollution or impacts to related aquatic wildlife habitat.

Cumulative hydrologic modifications:

Cumulative effects consist of the situations where activities by themselves generate insignificant NPS water pollution, but via accumulation, the impacts become significant. With hydrologic modification, insignificant hydrologic modifications accumulate and act together to initiate a water quality problem. This Hydromod Plan addresses those accumulations.

PRIORITIZATION AND IMPLEMENTATION

Utah's priority water bodies:

According to Table 6 of the State of Utah - Water Quality Assessment for 1992 [Section 305(b) Report] (DWQ, 1992) Hydrologic Modification accounts for major water quality impact to 181 miles of Utah river waterbodies. These river miles of waterbodies are not fully supporting their designated uses. A river basin assessment for the Jordan River Drainage indicates "impairments resulting from urban runoff, hydrologic modification, municipal and industrial sources, and agricultural activities." None of the other river basin assessments refer to hydrologic modification. However, frequent exceedences of total dissolved solids, temperature, and dissolved oxygen which are often attributed to agricultural and natural sources may be partially attributable to extensive hydrologic modifications that have occurred statewide. Efforts are being made to better identify impacts and impacting activities, especially for fishery habitat parameters, in the 1994 and 1996 305(b) Assessments.

The 1992 305(b) Assessment identified lakes affected by probable hydrologic modifications in a table (Table 19) titled: Total Size of Lake Waterbodies Not Fully Supporting Uses Affected By Various Source Categories. Selected portions of that table show:

Cause Categories	**Major Impact**	**Moderate / Minor Impact** (in acres of lake surface)
Hydrologic / Habitat Modification	98,699	3,350
Channelization	0	1,121
Dam Construction	252	638
Flow Regulation	637	733
Draining / Filling Wetlands	0	20
Upstream Impoundment	0	319

The Utah Division of Water Quality (DWQ) has identified 56 Priority NPS Watersheds in updates to the NPS Management Plan. These are listed in Table 32 of the 1992 305(b) Assessment. From this list, the Utah NPS Task Force has identified a short list of five high priority watersheds. These five watersheds were selected without regard to funding by §319. A major criterion was local interest and socio-economic feasibility. Other criteria included technological feasibility and the ability of cooperating agencies to provide technical assistance:

Upper Weber River and tributaries above the Stoddard Diversion
Little Bear River and tributaries
East Fork of the Sevier and tributaries including Otter Creek and tributaries
Jordan River and tributaries downstream from The Narrows
Beaver River and tributaries

The 1992 305(b) Assessment identified several practices above priority list lakes in Utah to address NPS pollution from hydrologic modification sources. These included "preventing excessive vegetation removal, preventing overgrazing, restricting excessive animal stream access, redirecting streams . . . , preserving streambank and slope stability..., and maintaining riparian vegetation along rivers and streambanks." These practices fall within activities for which Utah's Hydromod BMPs have been developed. They were developed by the Hydrologic Modification Subcommittee to the NPS Task Force. They are identified in the Best Management Practices section of this Hydromod Plan.

Implementation schedule:

Initial implementation of Utah's Hydromod BMPs will occur in conjunction with ongoing NPS control projects. The first of these include projects being implemented in the short list of priority watersheds identified above. Information about these projects is tabulated:

Project Name	Lead Agency	Year Initiated	Anticipated Completion Date
Little Bear River	Soil Conservation Service (SCS)	1989	1998
Chalk Creek	SCS	1990	2000
Otter Creek	SCS	1990	1998
Jordan River	Salt Lake County	1990	2004
Beaver River	DWQ	1991	2002

As watersheds are identified by cooperating agencies to have specific hydrologic modification impacts, they will be identified in the §305(b) Assessments on the list of Priority NPS Watersheds. The NPS Task Force then selects from this list additions to the high priority list for accelerated implementation as is determined necessary. Criteria used to add these watersheds will again include such things as local interest and socio-economic feasibility, technological feasibility, and the ability of cooperating agencies to provide technical assistance.

UTAH'S PLANNING STRATEGY

The planning strategy that Utah pursues to accomplish nonpoint source pollution control from hydrologic modifications follows the principles found in the Utah Coordinated Resource Management Planning Handbook and Guidelines (CRMP). This process stresses several elements necessary to achieve orderly and comprehensive planning:

1. direct communication between participants
2. inclusion of all interests and ownerships
3. consideration of resources and resource uses
4. respect of all rights and obligations of participants
5. recognition of existing laws and regulations
6. decision-making based on a consensus

Each of these elements is identified in the Hydromod Planning Process attached in Appendix B.

The planning entities:

Private landowners, water rights owners, public interest groups, and local, state, and federal government entities all play a role in the CRMP process. This is because these groups are the owners, managers, and users of the natural resources. In 1988, a Memorandum of Understanding for Coordinated Resource Management between six federal and four state agencies was signed[1]. These agencies agreed to promote and participate in local coordinated planning through an Executive Council and Task Group, each composed of the signatory agencies.

Roles and responsibilities:

The Utah NPS Task Force was organized for statewide nonpoint source (NPS) water pollution control planning and best management practice (BMP) implementation guidance. This group developed and periodically updates the Utah NPS Management Plan. The Environmental Protection Agency (EPA) approved the first version of this NPS Management Plan for urban and agricultural pollution sources, but not for hydrologic modifications.

[1]The agencies are: USDI Bureau of Land Management; USDA Forest Service; USDA Soil Conservation; Utah Department of Agriculture; Utah State University Extension; Utah Department of Natural Resources; USDA Agriculture Stabilization and Conservation Service; Utah Association of Conservation Districts; USDI Fish and Wildlife Service; and USDI National Park Service.

The Hydrologic Modification Subcommittee was subsequently formed as a work group of the Task Force. This group has several responsibilities:

1. provide a forum for cooperation and coordination by governmental agencies in addressing water pollution specific to hydrologic modifications;

2. develop the Hydromod Plan and provide technical assistance to the NPS Task Force in reviewing Utah's Hydromod BMPs;

3. provide ongoing assessment of the Hydromod Plan and propose updates every four years;

4. review hydrologic modification NPS control programs. These reviews include several steps:

    (a) review pertinent information;

    (b) identify, and suggest priorities for BMP implementation resources (including technical assistance and monetary resources);

    (c) propose program outputs and procedures (including hydrologic modification pollution prevention programs and BMP operation and maintenance assurances via the Hydromod Planning Process); and

    (d) propose program adjustments (including the formation of new programs or the discontinuance of ineffective programs).

5. review other (federal, state or local) resource management programs that have differing objectives but may provide indirect water quality benefits. Make recommendations to the Task Force that capitalize on these indirect benefits and otherwise achieve consistency between the programs. Examples of these differing objectives include soil erosion control, water conservation, flood plain management, wetland management and energy conservation *(i.e., water plans, Central Utah Project - CUP - fisheries mitigation, Colorado River salinity control, state floodplain management to coordinate river corridor management, river enhancement, open space preservation, etc.)*; and

6. ensure the consistency of reviewed programs with the overall Utah NPS program including the coordination with efforts arising from the other components of the NPS Management Plan (addressing the other pollution categories).

Agency participation on the NPS Task Force is extensive (please refer to the NPS Management Plan for a complete listing). Participation on the Hydromod Subcommittee is available to each agency on the Task Force. A core group includes the Utah Division of Water Quality (Department of Environmental Quality), the Utah Department of Agriculture, the Utah Department of Natural Resources, Utah State University Extension, and the USDA Soil Conservation Service.

The Utah Department of Environmental Quality, Division of Water Quality (DWQ) acts as lead agency for the State Nonpoint Source Pollution Management Program. Among other regulatory programs, DWQ is the designated state agency responsible for the development and implementation of water quality standards, water quality planning and management, nonpoint source program including §319, clean lakes §314 program, and water quality certifications (401 certification) of the Army Corps of Engineers 404 Permits. DWQ also acts as the Grantee for §319 CWA funds and assumes ultimate responsibility for monitoring and reporting of Grant performance for the EPA.

The Utah Department of Agriculture (UDA), pursuant to its Memorandum of Understanding with the DWQ, chaired the Hydrologic Modification Subcommittee and developed this Hydromod Plan. DWQ is the lead agency for the implementation and management of the plan. DWQ will also assume chairmanship of the Subcommittee upon NPS Task Force adoption and EPA final approval.

UDA will continue in a vital supporting role in implementing the Hydromod Plan. UDA provides comprehensive watershed project management and BMP auditing with technical assistance from SCS and Water Rights. UDA provides linkage to the Utah Soil Conservation Commission and to the state's 39 Soil Conservation Districts. One key role is in working with landowners in education efforts and in promoting project participation. UDA will also actively participate on the Hydrologic Modification Subcommittee and the NPS Monitoring Workgroup.

Utah's Department of Natural Resources will also provide support in implementation of the Hydromod Plan. The Utah Division of Water Rights has the responsibility to regulate stream alterations and to issue permits under the Stream Alteration Act (1971) and Section 73-3-29 Utah Code Annotated (U.C.A.), 1953 (see State regulation under REGULATORY PROGRAMS). Water Rights also has jurisdiction with most other hydrologic modifications. This Hydromod Plan recognizes their regulatory authority and readers must be aware that nothing in this Hydromod Plan is intended to replace or usurp their authority. In this capacity, Water Rights provides a key role in administering their programs, providing technical assistance to permit applicants, and coordinating agency review of those applications. Water Rights will also participate on the Hydrologic Modification Subcommittee. The Division of Wildlife Resources has the responsibility to manage Utah's wildlife resources and provides wildlife habitat information and technical support. Wildlife Resources will also actively participate on the Hydrologic Modification Subcommittee and the NPS Monitoring Workgroup.

All agencies that participate with and support the Hydromod Subcommittee may enter into contractual or Memorandum of Understanding (MOU) arrangements with DWQ in implementing hydrologic modification projects that protect or improve water quality.

As lead to the Hydromod Subcommittee, DWQ has several responsibilities:

1. oversee development and updates of the Hydromod Plan;

2. ensure the reassessment of Utah's Hydromod BMPs as they develop or improve on a four year cycle;

3. implement Utah's Hydromod BMP implementation program reviews as determined necessary including the participation of appropriate parties;

4. coordinate with participating agencies and organizations;

5. ensure satisfaction of Hydromod Subcommittee responsibilities; and

6. provide tracking and reporting of Hydromod Subcommittee activities.

A milestone schedule is included in Appendix A. Outputs include:

1. Hydromod Subcommittee activities

2. Hydromod Plan review and update

3. reviews of and revisions to Utah's Hydromod BMPs

4. implementation of Utah's Hydromod BMPs

5. reporting.

Hydrologic modification NPS control programs:

Utah's Hydromod BMPs are part of the overall hydrologic modification NPS control program. The Hydromod Planning Process provides a methodology to develop, refine, promote, and implement the delivery mechanisms for the site specific measures. Some references identify this type of methodology as a "process oriented BMP." The only "process oriented BMP" identified in this document would be the Hydromod Planning Process, which is not a BMP in itself, but is referred to by each of the Utah Hydromod BMPs. Examples of hydrologic modification NPS control programs include:

1. Information and education programs provide information about BMPs. Target audiences may be landowners, water rights owners, the general public, or other groups. These programs utilize the Information/Education strategy.

2. Regulatory programs, such as the Utah Stream Alteration Permitting Program administered by the Utah Division of Water Rights. These programs utilize the Regulation strategy.

3. Zoning which dictate BMPs which are appropriate for a given location. These programs utilize the Regulation strategy.

4. Planning programs determine which measures are appropriate while considering the objectives of all participants and interests. These programs utilize the Coordinated Resource Management strategy.

5. Incentive programs provide financial assistance for the implementation of BMPs in the regard that they benefit the public. These programs utilize the Financial Incentives strategy.

6. Research programs establish and verify standards and specifications which ensure that BMPs provide the intended benefits. These programs utilize the Initiative and Innovation strategy.

7. Agency coordination programs address competing public objectives, consolidate product or service delivery, and reduce governmental duplication. These programs utilize the Coordinated Resource Management strategy.

8. Site planning programs identify the optimum locations of activities. These programs utilize the Technical Assistance strategy.

REGULATORY PROGRAMS

Federal regulation:

The U. S. Army Corps of Engineers (Corps) has regulated activities in the nation's waterways since 1890. The original purpose was to protect navigation. Since then, new legislation and judicial decisions have expanded the Corps' programs. Now, in cooperation with the Environmental Protection Agency, the full public interest is considered for both the protection and utilization of water resources.

Section 10 of the Rivers and Harbors Act of 1899 (33 U.S.C. 403) prohibits the obstruction or alteration of navigable waters of the United States without a permit from the Corps. This includes any work in or over these waters, or which affects the course, location, condition, or capacity of such waters. Several waterways in Utah are deemed navigable:

1. Bear Lake is navigable;

2. Flaming Gorge Reservoir is navigable;

3. the Green River is navigable from Dinosaur National Monument to its confluence with Sand Wash Creek about 2 miles upstream of its confluence with Nine Mile Creek at the head of Desolation

Canyon, and from about 5 miles below its confluence with the Price River to its confluence with the Colorado River;

4. the Colorado River is navigable from its confluence with Castle Creek to 4.5 miles below the confluence of the Green River at the head of Cataract Canyon.

5. Lake Powell is navigable.

Section 10 and/or Section 404 permits are required for construction activities in, or over, these waterways.

Section 404 of the Clean Water Act (1977) (33 U.S.C. 1344) prohibits discharge of dredged or fill material, or excavation in waters of the United States without a permit from the Corps. "Discharge of dredged material" means any addition of dredged or excavated material into, including any redeposit of dredged material within, waters of the United States. "Waters of the United States" include essentially all surface waters such as all navigable waters and their tributaries, all interstate waters and their tributaries, all wetlands adjacent to these waters and all impoundments of these waters. Typical activities requiring these permits include:

1. depositing of fill or dredging material in waters of the U. S. or adjacent wetlands;

2. site development fills for residential, commercial, or recreational developments;

3. construction of revetments, groins, leaves, dams, dikes, and weirs;

4. placement of riprap and road fills; and

5. excavation.

Excavation activities that require a Section 404 permit include:

1. mechanized land clearing, ditching, channelization, and other excavation activities that destroy or degrade waters of the United States, including wetlands;

2. dredged or excavated material placed at a specific discharge site in waters of the United States; and;

3. runoff or overflow from a contained land or water disposal area.

Other laws that may affect the processing of permit applications by the Corps of Engineers include:

1. Utah Stream Alteration Act (1971, 1985)
2. National Environmental Policy Act
3. Fish and Wildlife Coordination Act
4. Endangered Species Act
5. National Historic Preservation Act
6. Federal Power Act
7. Wild and Scenic Rivers Act
8. National Fishing Enhancement Act

Types of permits:

Individual Permits are required for projects on navigable and/or waters of the United States which will have more than minimal impacts. Permits are issued following a full public interest review of an individual application. A public notice is distributed to all known interested persons. After evaluating all comments and information received a final decision on the application is made.

The decision to grant or deny a permit is based on a public interest review of the probable impact of the proposed activity and its intended use. Benefits and detriments are balanced by considering effects on items such as:

1. Conservation
2. Economics
3. Aesthetics
4. General Environmental Concerns
5. Wetlands
6. Cultural Values
7. Fish and Wildlife Values
8. Flood Hazards
9. Flood Plain Values
10. Food and Fiber Production
11. Navigation
12. Shore Erosion and Accretion
13. Recreation
14. Water Supply and Conservation
15. Water Quality
16. Energy Needs
17. Safety
18. Needs and Welfare of the People
19. Consideration of Private Ownership

The following criteria are considered by the Corps in the evaluation of applications:

1. the relative extent of the public and private need for the proposed activity;

2. the practicability of using reasonable alternative location and methods to accomplish the objective of the proposed activity; and

3. the extent and permanence of the beneficial and/or detrimental effects which the proposed activity is likely to have on the public and private uses to which the area is suited.

The Corps also evaluates applications for compliance with the Section 404(b)(1) Guidelines. The Corps can only permit the least damaging practical alternative under these guidelines. An important requirement of the Guidelines is that for activities which come under Section 404, it is presumed there are less damaging upland alternatives to non-water dependent activities that are proposed for special aquatic sites. Thus, under the Guidelines, the permit applicant must address in sequential order whether the special aquatic site can be avoided, and if not, why not. If it cannot be avoided, the applicant addresses how the impacts will be minimized and how unavoidable impacts will be compensated through creation or restoration. The Guidelines also require no significant degradation, and compliance with other laws. Anyone proposing work in “waters of the U.S.”, including wetlands, should contact the Corps (801-295-8380) early in the planning process.

State regulation:

The State Engineer has regulatory authority with most hydrologic modifications. These regulatory responsibilities are defined in Utah Code Annotated in Section 73-2-1(3)(a), which reads, "The state engineer shall be responsible for the general administrative supervision of the waters of the state and the measurement, appropriation, apportionment, and distribution of those waters." The waters of the state have been interpreted to include both surface and ground waters. Geothermal resources in the state of Utah have been interpreted by the Legislature as a water resource rather than minerals, as they are characterized in other states, and this responsibility is also delegated to the State Engineer. The Division of Water Rights is an office of public record for all water rights, dam safety, stream alterations, and water well drillers.

If water is to be diverted or used, that water must be filed on and be on record with the Division of Water Rights. The Division of Water Rights spends the majority of its time in handling applications--processing new applications, extensions of time on unperfected water rights, proof of appropriation and the subsequent certificates on perfected water rights. These applications are of many forms: new applications to appropriate, change applications, exchange applications, segregations, extensions of time to resume use, diligence claims for use prior to 1903, and underground water claims for ground water used prior to 1935.

The State Engineer is currently responsible for the distribution of surface and ground waters on 35 river systems in the state. River commissioners have been appointed in each river system area and they (with their deputies) assume the responsibility of seeing that waters are diverted in correct amounts at the appropriate times and that diversions are for the proper water users. These river commissioners interpret court decrees and applications filed with the Division of Water Rights to assure that the Prior Appropriation Doctrine is followed in the diversion of water for the respective water user. Commissioners that have responsibilities in ground water basins determine the extent of diversion and assume the responsibility to see that yearly diversion amounts are not exceeded.

The dam safety section has the responsibility of overseeing dam construction and repair. They review plans and specifications for this activity and they also perform periodic inspections on approximately 800 structures throughout the state. These inspections are carried out to assure that structures are maintained, that facilities can be operated and

that public safety is not jeopardized. Emergency Action Plans and Standard Operating Procedures for all high and some moderate hazard dams in the state are also on file.

The Division also has the responsibility for licensing and supervising water well drillers. Division notification is required for all water wells drilled in the State and logs of each well must be submitted upon well completion. Delinquent well drillers can receive a suspension of their license should they not comply with rules and regulations of this section.

The Division performs adjudications of water rights when ordered to do so by the various courts. These adjudications are usually the result of litigation or of complaints about water diversions, water allocations or interference problems. The adjudication ultimately results in a new court decree on a particular river system.

The stream alteration program is also supervised by the dam safety section. Currently the Division has been issued General Permit 40 by the Corps of Engineers. This allows the Division to assume the responsibility of the Corps for the dredge and fill operations under Section 404 of the Clean Water Act, with the exception of those drainages that have endangered species. The Division processes approximately 250-300 of these applications annually. The applications assure that projects located in natural stream channels are conducted to minimize effect to stream banks and beds.

Utah first regulated stream channels when the Legislature passed the Stream Alteration Act in 1971 under 73-3-29 of the Utah Code Annotated, 1953. The floods of 1983 and 1984 showed shortcomings in the law. In 1985, out of a desire to prevent unnecessary degradation to Utah's natural resources, the legislature, with guidance provided by the Corps of Engineers (Corps), modified the act by including regulatory authority over additional activities.

The strengthened act enabled Utah to apply for the above referenced statewide general permit, which was issued by the Corps as General Permit - 040 on October 23, 1987. This authorizes a State Stream Alteration Permit to fulfill the requirements of Section 404 of the Clean Water Act for many projects. More specifically, General Permit 040 does not apply if the project involves wetlands, Threatened or Endangered Species, properties listed on the National Historic Register, Navigable Waters, channel relocations, or the pushing of streambed material against a streambank using a bulldozer or similar equipment. The Stream Alteration Act requires a written permit from the State Engineer to alter or change the beds and banks of any natural stream. Any federal or state agency, county, city, corporation, or person desiring to change the course, current, cross-section, or natural stream environment must first obtain a Utah State Stream Alteration Permit from the State Engineer. Please note that a Stream Alteration Permit is required for many kinds of work authorized by the Corps under a General Nationwide Permit, or a General Regional Permit. Typical projects requiring Utah State Stream Alteration Permits include:

1. dredging or excavation in or adjacent to any natural stream channel.
2. erosion protection including jetties, gabions, riprap, concrete walls, etc.
3. channel adjustment or realignment due to road construction.
4. installation or maintenance of irrigation works, sediment basins, or water control structures.
5. utility line crossings and bridges, and
6. construction of any facility adjacent to and impacting the channel or its natural environment.

The decision to approve applications in whole or in part or to deny the permit is based on a public interest review to determine if the proposed alterations would unreasonably or unnecessarily interfere with the natural resources of the State of Utah. The State Engineer (as the Director of the Utah Division of Water Rights) through the review process evaluates:

1. Natural stream environment
4. Effects on existing water rights

2. Impacts to fish and wildlife
5. Recreational uses
3. Alteration of channel capacity

Criteria for evaluation are the same as those used by the Corps of Engineers. General Permit 040 eliminates duplication of both state and federal permits for most projects. An applicant receiving a state permit under General Permit 040 is in compliance with section 404 guidelines and does not need additional permits from the Corps. Likewise, an applicant obtaining an Individual Permit from the Corps has fulfilled state requirements and is in compliance with state law. A joint application form has been developed to satisfy requirements of both the Stream Alteration Program and the Corps 404 program. These are available at offices of both agencies.

The Utah Department of Environmental Quality also has regulatory jurisdiction. The Utah Water Quality Board and the Division of Water Quality staff are to maintain, protect, and enhance the quality of Utah's surface and ground water resources. The statutory authority for the board is contained in Sections 19-5-101 through 119, Utah Code Annotated 1953 as amended. Those sections describe the responsibilities and activities of the Water Quality Board and Division of Water Quality regarding water quality.

The Division of Water Quality also provides State 401 - Water Quality Certifications pursuant to Section 401 of the Federal Clean Water Act. The Clean Water Act provides that all applicants for a federal license or permit for activities that may impact the water quality of the waters of a State and/or the United States and/or adjacent wetlands must apply for and obtain state water quality certification, commonly known as State 401 - Water Quality Certification. Certification must be obtained prior to, and included as an integral part of, any permit or license application submitted to the affected federal agency. These include a Section 404, dredge and fill permit from the Corps of Engineers and a Federal Energy Regulatory Commission Permit or license to construct and operate a hydroelectric generating facility. The Division additionally provides agency review for Stream Alteration permit applications, General Permit 040, administered by the Division of Water Rights.

County regulation:

The Utah State Code annotated, Titles 17-8-5, and 17-8-5.5, delegate counties the authority and responsibility for flood control activities within both unincorporated county and incorporated municipal boundaries. This authorizes counties to regulate development within stream or river flood channel/meander boundaries, as defined historically, by more recent hydrologic measurements, or through the use of flood discharge projection models.

Municipal regulation:

The Utah State Code annotated, Title 17-27-101 et. seq., authorizes counties and cities to control land use within their respective boundaries. Such controls include the "police powers" to zone property for appropriate uses to protect public health, safety, and welfare. Within zoning ordinances, conditional permits can be granted in sensitive areas which may require set-backs, buffer zones, or dedications of property for the public good.

BEST MANAGEMENT PRACTICES

Utah's Nonpoint Source Management Plan of 1988 describes Best Management Practices (BMPs):

> "BMPs may be defined as methods, measures or combination of measures that are determined by an agency after problem assessment to meet its nonpoint source pollution control needs. They include, but are not limited to, structural and nonstructural controls, and operation and maintenance procedures."

Section 6217(g) of the Coastal Zone Act Reauthorization Amendments of 1990 defines "management measures" of nonpoint pollution as:

> "economically achievable measures for the control of the addition of pollutants from existing and new categories and classes of nonpoint sources of pollution, which reflect the greatest degree of pollutant reduction achievable through the application of the best available nonpoint pollution control practices, technologies, processes, siting criteria, operating methods, or other alternatives."

Utah's Hydromod BMPs:

Utah's Hydromod BMPs identify application standards for each hydrologic modification activity. Each Utah Hydromod BMP also refers to the Hydromod Planning Process. The Utah NPS Task Force will support site specific measures or BMPs as treating hydrologic modification NPS pollution when they satisfy the application standards in the Utah Hydromod BMP and in the Hydromod Planning Process.

Each Utah Hydromod BMP is used to develop and implement site specific measures to control hydrologic modification NPS pollution (and impacts to related aquatic wildlife habitat) from that activity. As such, Utah's Hydromod BMPs are organized according to the hydrologic modification activities they address. These Hydromod BMPs are attached in Appendix B.

Many agencies and institutions have developed BMPs. These BMPs are listed on the Utah Hydromod BMPs as examples. But for an activity to be considered a hydrologic modification BMP in Utah it must satisfy the application standards identified in the appropriate Utah Hydromod BMP and in the Hydromod Planning Process. Each site will require location specific design, implementation, and maintenance.

When using Utah's Hydromod BMPs, it is critical to identify the hydrologic modification activity that currently causes or will potentially cause the pollution (and impacts to related aquatic wildlife habitat). Every effort should be made to avoid, discontinue, or manage the activity. This is stipulated in the general Hydromod Planning Process. Only then should site specific measures be developed in order to remediate the hydrologic modification NPS pollution.

For example, a trans-basin diversion may potentially cause tremendous riparian area damage because flows will greatly exceed the river's geomorphic capacity. To not build the diversion due to water quality concerns would discontinue the activity. Constructing a pipeline to take the additional flows around the area of concern would avoid the water quality and aquatic habitat impacts from the hydrologic modification. These alternatives should be identified and considered when using the Hydromod Planning Process. (If discontinuing or avoiding the activity becomes the chosen alternative, then it can be identified as a NPS Task Force supported hydrologic modification BMP). To manage the flow regime in a manner that minimizes the water quality impacts would be another alternative. The application standards identified in the Utah Trans-basin Diversions BMP would then need to be followed.

Also, for each hydrologic modification, it is important to involve an appropriate mix of natural resource management expertise. But it is **critical** to involve all parties with decision-making authority, including the land owner and water rights owners. This is an integral part of the Hydromod Planning Process, and is included in each Utah Hydromod BMP by reference.

One thing must be kept firmly in mind when treating nonpoint source pollution from hydrologic modifications: it is still an inexact science. There remains significant leeway in what can be identified as "best." Also, what is best varies from site to site. There are several criteria used to determine that a site specific measure is best. First, it must be effective at protecting water quality for beneficial uses. Second, every effort should be made to avoid, discontinue, or manage the activity. Third, the hydrologic modification activity must satisfy the application standards identified in each applicable Utah Hydromod BMP (attached in Appendix B). Fourth, it must identify provisions for operation and maintenance that continue to protect water quality (identified in the Hydromod Planning Process).

The 1988 Nonpoint Source Management Plan narrated one important aspect of BMPs:

> "Best Management Practices cannot be viewed in isolation. They must be seen as a management strategy, an approach, or a system. Seldom is one practice sufficient to resolve a nonpoint source problem. A combination of practices is usually required along with a management philosophy of commitment to reducing nonpoint pollution. It is rarely sufficient to install a practice and forget it. BMPs and systems require an ongoing maintenance and management effort which must be recognized at the outset."

Often, several location specific measures are combined into an RMS (resource management system). The RMS includes other practices that may not necessarily be concerned with controlling NPS pollution from hydrologic modifications. A RMS plan then becomes the combination of resource management systems that addresses both resource management and resource protection objectives. The ability of the plan to be sustainable (environmentally and socio-economically viable over the long term) becomes a real art practiced by both the resource management planner and by the resource manager.

Adoption process for Utah's hydrologic modification BMPs:

In Utah, BMPs for hydrologic modification were developed by the Hydrologic Modification Subcommittee. They then went through a public scoping process which included a public notice, a 30-day public comment period, and public meetings as requested. Finally, the BMPs and associated comments were considered by the Utah NPS Task Force and were adopted in conjunction with this Hydromod Plan. In this manner, Utah's Hydromod BMPs and the Hydromod Plan became a portion of Utah's NPS Management Plan.

The adopted Utah Hydromod BMPs and Hydromod Plan (addendum to the NPS Management Plan) were forwarded to the EPA for their approval. This was because Congress has appointed the Administrator of the EPA to administer the Clean Water Act. Section 319 (b) describes State Management Plans (to address nonpoint sources of water pollution): "The Governor of each State, . . . shall, after notice and opportunity for public comment, prepare and submit to the Administrator for approval a management program. . .for controlling pollution added from nonpoint sources. . ."

The Hydromod Subcommittee will review, at least once every four years, the list of Utah's Hydromod BMPs. This is in order to update existing BMPs and to consider additional hydrologic modification activities that may need additional or refined BMPs.

If an innovative BMP is proposed, it should be designed and implemented so that it satisfies the applicable Utah Hydromod BMP and the Hydromod Planning Process. If it is shown to be effective, then the BMP will be added to the list of example BMP standards and specifications for that applicable Utah Hydromod BMP.

Appendix A

Milestones Schedule

Outputs	Milestone
Addendum Schedule	
30-day Public Comment Period	October 13-November 12, 1993
Adoption by the NPS Task Force	June 1994
Addendum Updates	Every Four Years
Hydromod Subcommittee	
Coordination with BMP implementation agencies	Ongoing
Recommendations to NPS Task Force	Annual
Ensure consistency	Ongoing
Hydromod BMPs	
Review of 25% to update and refine	Annual
Public Scoping	Every Four Years
DWQ	
Reporting	Annual
Implementation of BMPs	(a) In conjunction with ongoing NPS control projects (see table below) (b) As priority watersheds are identified by DWQ to have specific hydromod impacts and are designated by the NPS Task Force as having high priority

Project Name	Lead Agency	Year Initiated	Anticipated Completion Date
Little Bear River	Soil Conservation Service (SCS)	1989	1998
Chalk Creek	SCS	1990	2000
Otter Creek	SCS	1990	1998
Jordan River	Salt Lake County	1990	2004
Beaver River	DWQ	1991	2002

Appendix B

Hydrologic Modification Activities and Corresponding BMPs

Pollution control considerations should occur with most hydrologic modifications. These include planning, appropriate construction practices, and appropriate operation and maintenance activities. Hydrologic modifications of any type pursued during emergency situations should follow application standards for water quality protection as well. Planning considerations are specified in Utah's Hydromod Planning Process. The Measures to Control Construction Activities BMP and the Emergency Measures BMP may also apply with a particular hydrologic modification depending upon circumstance:

Hydrologic Modification Activities Outline:

(1) Activities that alter or restore the flow regime of a body of water:

A. Streams
1. Trans-basin diversions
BMP - Trans-Basin Diversions 7
2. Diversions
BMP - Diversions 9
3. Impoundments
BMP - Impoundments 11
4. Watershed activities (BMPs for these activities are identified in other components of the NPS Management Plan according to the type of activity)

B. Lakes and reservoirs

C. Ground water including shallow aquifers
BMP - Ground Water Withdrawal/Recharge 13

D. Cumulative hydrologic modifications
These are addressed using the Hydromod Planning Process

(2) Near-stream or instream activities that alter or restore the function or stability of a stream channel or its floodplain:

A. Stream channels
BMP - Channel Realignment 15
BMP - Grade Control 17
BMP - In-Stream Structures 19
BMP - Stream Crossings 21
BMP - Bank Stabilization 23
BMP - Channel/Floodplain Extraction or Re-Working 25
BMP - Fish Habitat Enhancement 27

B. Floodplain areas
BMP - Flood Control Practices 29
BMP - Riparian/Floodplain Modification 31
BMP - Wetland Enhancement 33

HYDROMOD PLANNING PROCESS

Definition: A standard planning process for hydrologic modification BMP development, implementation, and documentation. This process includes several **critical** items:

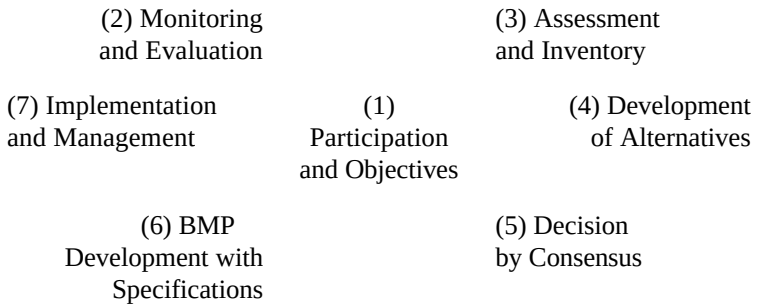
1. the identification of the hydrologic modification activity;
2. the development and consideration of alternatives that **avoid or discontinue the activity**, that **manage or modify the activity**; and that fully represents a range of possibilities; and
3. the participation of all appropriate stakeholders (including the landowner and potentially affected water rights owners) in making the decisions;

Objective: To identify a planning method that directs the protection of water quality and of beneficial uses during hydrologic modification activities. Three components are essential in achieving and demonstrating success:

1. sufficient information that supports good decision making and that demonstrates success;
2. the availability of effective alternatives for and appropriate participation with the decision; and
3. the resolve to develop and implement the decisions made including follow-through with provisions for operation and maintenance activities.

Process Application Standards:

For a practice to be considered a hydrologic modification BMP in Utah, it must be able to satisfy the following seven planning elements. Most simply, this process can be portrayed in a honeycomb diagram:



Instructions for using these planning elements:

1. Provide broad participation whereby technical, financial, and historical resources are garnered as necessary to accomplish three things:

    a. designating leadership,
    b. formulating the resource management objectives (including the protection of water quality and of beneficial uses during the hydrologic modification activity); and
    c. accomplishing each step of the planning process.

    Do not progress step-by-step through the seven elements. The process can be modified as needed. For example, if enough information is not available to adequately determine objectives, then jump to element (3) until enough information is available to satisfy element (1). The person designated as leader will ensure that each element is met in a manner that the group determines is most effective. The leader will also ensure that the first two principles of the CRMP process are fulfilled:

    (1) direct communication between participants

(2) inclusion of all interests and ownerships

2. Design monitoring and evaluation mechanisms in order to adequately demonstrate the achievement of the objectives. This element is identified as second because once the objectives are known, the evaluation mechanisms must be considered. It could have as easily been placed last, in fact, most planning processes do place it last. The element will need to be revisited during and after the fulfillment of the implementation and management element or "last".

3. Obtain sufficient pertinent information in order to support adequate decision-making including the assessment and inventory of natural resource processes and conditions, of economics, of sociological consequences, and the identification of roles and responsibilities, laws and regulations, and previous studies. These include, but are not limited to, a good understanding of the hydrologic modification activity, stream or water body characteristics (i.e., flow regime and dynamics, geomorphic and geologic character and response, vegetative community and stage, aquatic habitat and response, and water quality and response). The leader will ensure that the third and fifth principles of the CRMP process are fulfilled:

   (3) consideration of resources and resource use
   (5) recognition of existing laws and regulations

4. Develop an adequate variety of alternatives in order to increase the likelihood of success given the particular resource conditions, economics, and circumstances. Include alternatives that avoid or reduce impacts from the activity and that manage the activity.

5. Obtain a decision that represents a consensus opinion of those who are appropriately involved with the decision. The leader will ensure that the fourth and sixth principles of the CRMP process are fulfilled:

   (4) respect of all rights and obligations of participants
   (6) decision-making based on consensus

6. In developing the site specific BMP, adhere not only to the application standards set by the Utah Hydromod BMP for the activity, but adhere to all other applicable standards, specifications, rules, regulations, etc. Incorporate the BMP into other BMPs and natural resource management activities.

7. Allocate sufficient attention and resources to long-term management of the activities and maintenance of implemented facilities in order to achieve long term management of the hydrologic modification activity and its effects including the protection of water quality and beneficial uses.

Concerns:

All federal, state, and local laws, regulations, and permitting requirements which may apply must be followed. Additionally, this planning process requires commitment by its participants. Hidden agendas and political maneuvering can circumvent any progress. These agendas should be brought to the forefront and incorporated into the collective objectives. If they aren't, the objectives may not be satisfied.

References:

CRMP - Banner, Roger E. 1989. Utah Coordinated Resource Management and Planning Handbook and Guidelines. Utah Coordinated Resource Management and Planning Executive Council and Task Group. Utah State University Cooperative Extension Service. EC - 436.

CRMP - Anderson, E. William, and Baum, Robert C. 1988. How To Do Coordinated Resource Management Planning. Journal of Soil and Water Conservation, May-June 1988, Volume 43, Number 3: p216-220.

NCPM - USDA Soil Conservation Service, 1984. National Conservation Planning Manual, 180-V, Issue UT-1, Part UT-580, Project Planning.

MEASURES TO CONTROL CONSTRUCTION ACTIVITIES

Definition: Standards for construction activities conducted in or adjacent to surface water bodies.

Objective: To protect water quality and related aquatic wildlife habitat during and after the construction of hydrologic modifications.

Conditions where practice applies: Practices apply to all construction activities related to structure placement, channel modification or streambank stabilization, channel crossings, riparian modification, road construction, and site development that are conducted in stream channels, riparian areas, and floodplains.

BMP application standards: It is necessary to protect water quality and beneficial uses during the construction of hydrologic modifications. Four concepts are important with these construction activities: 1. minimize the **area and time** of land/channel disturbance; 2. manage and **control runoff** between the disturbed area and the stream or lake; 3) **time the activity** to minimize exposure of disturbance to high streamflow or lake levels; and 4. **stabilize disturbed soils** to prevent sediment detachment.

1. Time construction activity to occur during periods of low flows and to avoid periods of aquatic life cycle sensitivity (spawning, etc.). Consult the Utah Division of Wildlife Resources to determine appropriate periods of acceptable construction.

2. Minimize disturbance in the channel by conducting only essential access and work in stream area. Conduct staging activities, material/equipment storage, equipment servicing, and excavated material placement well away from the stream. Use physical markers (flagging, stakes) to delineate area to be disturbed.

3. Minimize the length of time that stream specific construction occurs. Consolidate channel work and complete the installation without interruption. Avoid conducting concurrent site activities that may delay channel work and increase exposure time of disturbance.

4. Conduct the construction activity in phases. Avoid area-wide clearance of the construction site. Disturb areas in small parcels and stabilize them before proceeding with next phase.

5. Ensure that all needed materials, manpower, and equipment are available on-site prior to initiating **any** disturbance in the stream channel/floodplain and tributaries.

6. Protect existing vegetation except where removal is essential for work completion.

7. Dispose of excess material (excavated, debris, vegetation) out of the stream channel/floodplain.

8. Prevent wet cement from entering the water. Cement is highly toxic to aquatic organisms. Ensure that all concrete used during construction is set before allowing contact with streamflow. Wash equipment used during concrete work well away from the stream channel/floodplain and tributaries.

9. Minimize stream fords for equipment. Stream bed alteration should not be done. Limit crossing frequency to absolutely essential trips (refer to Stream Crossings BMP).

10. Do not conduct work below the existing water level, except for essential preparation for footings or culvert beds. If project involves excessive disturbance below the water level, use coffer dams and divert flows as possible.

11. Control runoff from disturbed areas using temporary ditches, berms, catch basins, and pitting.

12. Install temporary sediment control measures (e.g., silt fencing, straw bales, ditches) **prior to initiating construction** in the stream channel/floodplain.

13. Completely remove all structures/temporary controls from the site at the conclusion of the construction activity. Remove and dispose sediment accumulated in temporary sediment controls away from the stream environment or redistribute it and stabilize it as topsoil.

14. Immediately install permanent stabilization controls for disturbed areas (revegetation, revetments, riprap, biotechnical controls) following construction. Some delays may be acceptable for seasonal timing of revegetation (seeding). Maintain temporary controls until the disturbed area is adequately stabilized.

Concerns: Construction activities within the stream channel have significant potential to degrade water quality and exceed State Water Quality Standards (Utah Administrative Code, R-317-2, et. seq.). However, consistent application of construction BMPs will significantly reduce impacts. Construction within the stream channel is classified as a stream alteration and is regulated in the state by the Utah Division of Water Rights and requires acquisition of a permit. Significant activity may also be regulated by the Army Corp of Engineers under the 404 permit program. Each of these agencies must be consulted and the appropriate permits obtained prior to initiation of construction. Project success can be greatly enhanced with planning and personal commitment to reduction of sediment introduced into the stream environment.

Examples of BMP specifications:

water and sediment control basin (SCS-#638)
fords (WMT-C4)
culverts (UWR-9.7, WMT-C2, FRM-312-323)
crossing placement (WMT-C1)
diversion of flows around construction sites (USFS-15.14)
silt fences, Filter fabric (EPA, 1992)
straw bales, check dams (EPA, 1992)
sediment traps (EPA, 1992)
seeding and mulch/mats (EPA, 1992)
erosion control structure maintenance, (USFS-14.18)
perimeter controls (flagging, fencing, staking) (EPA, 1993)

References:

SCS-# - USDA Soil Conservation Service. Field Office Technical Guide. Practice #

WMT - Musclow, H.J., and L.B. Dalton. 1990. Wildlife Mitigation Technologies for Man-Made Impacts. Utah Department of Natural Resources, Division of Wildlife Resources. Publication Number 90-3.

UWR - State of Utah, Administrative rules for Stream Channel Alterations, Division of Water Rights, Robert Morgan, P.E. State Engineer. Reprinted 1991. State Archives No. 8858.

FRM - Meehan, W.R. 1991 Influences of Forest and Rangeland Management on Salmonid Fishes and Their Habitats. American Fisheries Society, Special Publication 19. Bethesda, Maryland.

USFS - USDA Forest Service, Region 4, 1988. Soil and Water Conservation Practices Handbook. Ogden, Utah. Forest Service Handbook 2509.22

EPA - United States Environmental Protection Agency. 1993. Guidance Specifying Management Measures For Sources Of Nonpoint Pollution In Coastal Waters. Washington D.C. EPA 840-B-92-002.

EPA - United States Environmental Protection Agency. 1992. Storm Water Management For Construction Activities: Developing Pollution Prevention Plans And Best Management Practices. Washington D.C. EPA 832-R-92-005.

EMERGENCY MEASURES

Definition: Standards for placing hydrologic modifications in emergency situations involving immediate, potential or actual injury or damage to person or property.

Objective: To protect water quality and related aquatic wildlife habitat to the extent possible, and to ensure appropriate reclamation of these resources after the event.

Conditions where practice applies: This BMP applies whenever a hydrologic modification activity occurs in order to prevent injury or damage to persons or property. These conditions are characterized for stream alterations in section 73-3-29 (2)(b) Utah Code Annotated, 1953: "If an emergency situation arises which involves immediate or actual flooding and threatens injury or damage to persons or property, steps reasonably necessary to alleviate or mitigate the threat may be taken before a written permit is issued subject to the requirements of this section." Authority to pursue emergency adjudicative proceedings is given to authorized state agencies in section 63-46b-20, Utah Code Annotated, 1953.

BMP application standards:

1. It is necessary to protect water quality and beneficial uses while placing hydrologic modifications during emergency situations. To the extent possible, apply both the Hydromod Planning Process and the Measures To Control Construction Activities BMP. Persons implementing these activities remain responsible for adhering to applicable laws, rules and regulations.

2. To the extent possible, refer to the applicable hydromod BMP when developing the activity.

3. Keep the amount of disturbance as low as possible.

4. To the extent possible, work with natural processes such as river dynamics. Provisions should be made to accommodate natural water resource events such as floods.

5. Identify and make appropriate repairs when the emergency is over. Apply the Hydromod Planning Process and the Measures to Control Construction Activities BMPs as well as other applicable BMPs. Persons implementing these activities remain responsible for filing for applicable after-the-fact permits such as Stream Alteration Permits.

6. Develop contingency plans prior to emergency situations. It is better to be prepared beforehand. See Flood Control Practices BMP.

Concerns: It is very important for land and water rights owners and managers to understand their legal responsibilities in implementing emergency hydrologic modifications.

Examples of BMP specifications:

emergency fills (WYO-p40)

References:

WYO - Emergency Fills, Practice #14. Draft Hydrologic Modifications Best Management Practices, Wyoming Nonpoint Source Management Plan. Wyoming Department of Environmental Quality.

TRANS-BASIN DIVERSIONS

Definition: Standards for diverting stream-flows from one drainage basin to another.

Objective: To protect water quality and related aquatic wildlife habitat as changes to historical stream-flows in the involved basins are made (from decreased stream-flows in the contributing drainage basin and from increased stream-flows in the receiving drainage basin).

Conditions where practice applies: On diversions of water from one drainage basin to another.

BMP application standards:

1. It is necessary to protect water quality and beneficial uses while diverting water from one drainage basin to another. Apply the Hydromod Planning Process in planning and developing trans-basin diversions. Apply the Measures To Control Construction Activities BMP in implementing and constructing trans-basin diversions. Persons implementing these activities remain responsible for adhering to applicable laws, rules and regulations.

2. Minimize sediment levels to streams while operating trans-basin diversions, especially during sluicing activities.

3. Work to maintain instream flow regimes, of an adequate volume and duration in downstream environments of the contributing drainage basin. This is intended to protect stream channel function and habitat for the aquatic resources, including water quality parameters such as temperature. This objective does not supercede regulatory requirements or diversions for legitimate water rights.

4. Reduce adverse impacts of extreme high flow regimes such as downcutting and aggravated bank erosion in the receiving drainage basin by using conveyance systems other than existing stream channels, such as pipelines.

5. For any impoundments associated with trans-basin diversions, see the Impoundments BMP.

6. Develop long term operation and maintenance procedures in order to meet the specified objectives (see the Hydromod Planning Process).

Concerns: There must be an existing valid water right to pursue a trans-basin diversion (Utah Code Annotated, Sections 73-3-3 and 73-3-8). Trans-basin diversions have the potential to dewater stream reaches of the donating drainage basin, destroying the associated aquatic and riparian resources, and increasing flows over the historical levels in the receiving basin. Monitor legitimate instream flow regimes in order to assess their effectiveness and protect them as is appropriate from further flow depletion. Pipelines used to convey the additional flows in the receiving drainage basin require operation and maintenance. An environmental assessment on the location of these pipelines is recommended. A Stream Channel Alteration Permit is required.

Examples of BMP specifications:

flow release timing management (HSIIF) (IIFR)
channel maintenance flows (CMFC)
fishery and/or riparian vegetation maintenance flows (HSIIF) (IIFR)

References:

HSIIF - Bovee, K.D. and R. Milhous. 1978. Hydraulic simulation in instream flow studies: theory and techniques. In-stream Flow Information Paper 5. FWS/OBS-78/33 130 p.

IIFR - Tennant, D.L. 1976. In-stream flow regimens for fish, wildlife, recreation and related environmental resources. *in* Orsborn, J.F. and C. H. Allman editors. Proceedings of the Symposium on Instream Flow Needs. Western Division of American Fisheries Society. Volume II. 657 p.

CMFC - Rosgen, D.L., H.L. Silvey and J.P. Potyondy. 1986. The use of channel maintenance flow concepts in the Forest Service. Hydrological Science and Technology: Short Papers. Vol. 2. Number 1, p. 19-26.

DIVERSIONS

Definition: Standards for placing and operating structures or devices within or on the banks of a channel for the purpose of diverting and distributing water which has been appropriated by an active water rights claim.

Objective: To ensure adequate river function and to protect water quality and related aquatic wildlife habitat during the placement and operation of these structures or devices.

Conditions where practice applies: Any stream channel where an active water right and point of diversion have been established.

BMP application standards:

1. It is necessary to protect water quality and beneficial uses during the placement, operation, and maintenance of diversions. Apply the Hydromod Planning Process in planning and developing diversions. Apply the Measures to Control Construction Activities BMP in constructing diversions. Persons implementing these activities remain responsible for adhering to applicable laws, rules and regulations.

2. Design diversions that can pass the sediment load. Typically these are smaller in size.

3. Develop maintenance procedures for larger structures which trap sediment in order to minimize impact to the surrounding environment and aquatic environment. Remove dredged material and dispose of it away from the stream environment or redistribute it as topsoil and revegetate. Perform sluicing activities in accordance with sluicing guidelines.

4. Design diversions so that pushing or dredging streambed material to divert flow is not necessary or with large diversions, kept to a minimum.

5. Use materials in constructing diversions that are suitable for use in a natural stream channel. Demolition debris, asphalt, garbage, loose plastic, car bodies, etc. are not suitable material.

6. Locate diversions in sites that avoid changes in base elevation. An increase in bed elevation of the channel will result in increase channel meander, width, deposition, and bank instability.

7. Larger diversions may require bank stabilization upstream and downstream of the structure.

8. Maintenance of structures can be reduced and efficiency improved if channel geometry and morphology are considered when the structures are sited.

9. Develop long term operation and maintenance procedures in order to meet the specified objectives (see the Hydromod Planning Process). General operation and maintenance must be accomplished in such a way to minimize impact to the aquatic environment and riparian zone.

Concerns: There must be an existing, valid water right to place a diversion (Utah Code Annotated, Sections 73-3-3 and 73-3-8). Placing a diversion structure is a serious impact to a natural stream channel. Natural stream processes are usually not allowed to continue. Channel location is controlled and natural stream migration is not allowed. Sediment transported by flows is often trapped behind the structures, creating a maintenance problem and continual impact to the system. Sediment balance downstream of the structure in the same manner is disrupted and channel degradation can occur. Large structures which take a substantial amount of flow, but bypass sediment, become unable to transport sediment downstream of the structure. Deposition of bedload immediately below the structure which forms mid-channel and side- channel sediment bars. Sluicing of organic rich sediment from behind structures endangers aquatic wildlife. A Stream Channel Alteration Permit is required.

Examples of BMP specifications:

diversion structures (UWR-9.8)
diversion dam (SCS-#348)
Utah sluicing protocol (DEQ)
fish screens and barriers (WMT-B3)
submerged weirs (WMT-B3)

References:

UWR - State of Utah, Administrative rules for Stream Channel Alterations, Division of Water Rights, Robert Morgan, P.E. State Engineer. Reprinted 1991. State Archives No. 8858.

SCS-# - USDA Soil Conservation Service. Field Office Technical Guide. Practice #

DEQ - A Sluicing Protocol for Utah, Utah Division of Water Quality, Department of Environmental Quality. DRAFT, 1993

WMT - Musclow, H.J., and L.B. Dalton. 1990. Wildlife Mitigation Technologies for Man-Made Impacts. Utah Department of Natural Resources, Division of Wildlife Resources. Publication Number 90-3.

IMPOUNDMENTS

Definition: Standards for placing and operating structures that impound water, such as dams for irrigation, stock-watering, water supply, recreation, wastewater treatment and flood control. These impoundments impact the downstream environment via changes in streamflow regime, and impact the upstream environment via changes in channel grade.

Objective: To protect water quality and related aquatic wildlife habitat during the construction, operation and maintenance of these impoundments.

Conditions where practice applies: On all impoundments of water, such as dams, reservoirs, ponds, stock ponds, retention basins and others, including off stream and on stream impoundments.

BMP application standards: Construction, operation and maintenance practices of impoundments should be evaluated on a site specific basis. Some general standards are:

1. It is necessary to protect water quality and beneficial uses during the placement, operation, and maintenance of impoundments. The Hydromod Planning Process should be applied in planning and developing impoundments. The Measures to Control Construction Activities BMP should be applied in implementing and constructing impoundments. Persons implementing these activities remain responsible for adhering to applicable laws, rules and regulations.

2. Minimize sediment levels to streams during construction and maintenance (e.g., sluicing) activities.

3. Maintain flow regimes of an adequate volume and duration in downstream environments to protect habitat for the aquatic resources, including riparian vegetation and maintain the physical channel.

4. Maintain adequate water quality in the downstream environments (e.g., temperature, dissolved oxygen, gas supersaturation and pH) to protect the beneficial uses.

5. Line wastewater impoundments to prevent movement of pollutants to groundwater or surface waters.

6. Develop long term operation and maintenance procedures in order to meet the specified objectives (see the Hydromod Planning Process).

Concerns: There must be an existing valid water right when placing and operating an impoundment (Utah Code Annotated, Sections 73-3-3 and 73-3-8). Also, a Stream Channel Alteration Permit is required.

Large on-stream impoundments have the potential to impact downstream reaches of the stream, from both water quantity and water quality aspects. The CRMP process is recommended to minimize all adverse impacts, related to new impoundments. The NEPA review process is required on federal projects.

Sluicing protocols are recommended, but are not regulated or administered by any agency. These protocols are currently under development and review by the U.S. Army Corps of Engineers.

All impounding structures are subject to the Dam Safety Act of 1990, administered by the Utah Division of Water Rights. Their program regulates safety related to the integrity of the impounding structure, and proximity to human populations. The law requires dam owners to formalize their Standard Operating Plans (SOP). These SOPs should include operation standards to minimize downstream impacts to the aquatic resources (e.g., sluicing).

Examples of BMP specifications:

regulating reservoirs (SCS-#552-B) (WMT-B2) (IIFR) (CMFC)
irrigation storage reservoirs (SCS-#436) (HSIIF) (IIFR) (GERT) (CMFC)
dam, multipurpose (SCS-#349) (HSIIF) (IIFR) (GERT) (CMFC)
Utah sluicing protocol (DEQ)
lakes and ponds (WMT-A1)
multilevel penstocks (WMT-B2) (GERT)
wastewater disposal ponds (WMT-E1)
sediment control basins (SCS-#350)
flood retarding dam (SCS-#402)

References:

SCS-# - USDA Soil Conservation Service. Field Office Technical Guide. Practice #

WMT - Musclow, H.J., and L.B. Dalton. 1990. Wildlife Mitigation Technologies for Man-Made Impacts. Utah Department of Natural Resources, Division of Wildlife Resources. Publication Number 90-3.

IIFR - Tennant, D.L. 1976. In-stream flow regimens for fish, wildlife, recreation and related environmental resources. *in* Orsborn, J.F. and C. H. Allman editors. Proceedings of the Symposium on In-stream Flow Needs. Western Division of American Fisheries Society. Volume II. 657 p.

CMFC - Rosgen, D.L., H.L. Silvey and J.P. Potyondy. 1986. The use of channel maintenance flow concepts in the Forest Service. Hydrological Science and Technology: Short Papers. Vol. 2. Number 1, p. 19-26.

HSIIF - Bovee, K.D. and R. Milhous. 1978. Hydraulic simulation in in-stream flow studies: theory and techniques. In-stream Flow Information Paper 5. FWS/OBS-78/33 130 p.

GERT - Armour, Carl L. 1991. Guidance for Evaluating and Recommending Temperature Regimes to Protect Fish. U.S. Fish Wildl. Serv., Biol. Rep. 90(22). 13 pp.

DEQ - A Sluicing Protocol for Utah, Utah Division of Water Quality, Department of Environmental Quality. DRAFT, 1993

GROUNDWATER WITHDRAWAL/RECHARGE

Definition: Standards for activities that alter the exchange of water in groundwater systems that change the rate and direction of ground water movement (and attendent pollutants) between surface waters and associated aquifers.

Objective: To minimize and prevent, to the extent possible, adverse impact to surface water/ground water quality and quantity from changes in the direction and quantity of groundwater supply.

Conditions where practice applies: In all aquifer and water table systems that influence the hydrology of a surface water body and where saline groundwater/fresh groundwater aquifer boundary conditions occur.

BMP application standards: Recognition that the groundwater/surface water system is a highly interrelated system and that withdrawal (pumping) and recharge (infiltration) practices can effect the flow (and associated pollutant) direction in the surface water/ground water regime is the basis for decisions regarding groundwater use and the selection of Best Management Practices. Pumping groundwater for use can lower existing water table elevations resulting in decreased supply rates to the stream and in extreme cases, drawdown can be sufficient to reverse the groundwater flow direction. Flow reversal can result in loss of flow from the stream to the groundwater or it can direct the flow from a polluted or saline aquifer to an uncontaminated system. Recharge activities (ponds, infiltration basins & trenches, injection wells) can similarly alter the groundwater flow rate and direction relative to the stream baseflow.

Due to the diverse nature of projects that can have an effect on the groundwater/stream hydrology and the interrelated factors effecting flow rates and pollutant loads/rates, the activities and selection of appropriate BMPs should be carefully analyzed on a project specific basis. The selection and implementation of BMPs will be influenced by how closely the groundwater system is hydrologically connected to surface waters, the quality of the waters, the presence of saline/fresh groundwater boundaries, the ownership of water rights, and the significance of the volume of withdrawal or recharge.

1. It is necessary to protect water quality and beneficial uses when changing the rate and direction of ground water movement (and attendent pollutants) between surface waters and associated aquifers. Plan and coordinate withdrawal/recharge activities as feasible to maintain in-stream flow regimes and water quality in downstream environments using the Hydromod Planning Process. Persons implementing these activities remain responsible for adhering to applicable laws, rules and regulations.

2. Conduct withdrawal/recharge activities in a manner that minimizes adverse impacts to baseflow reduction (dilution potential) and maintains adequate water quality to protect beneficial uses to the extent possible.

3. Conduct withdrawal activities in a manner that maintains adequate water supply (water table) to sustain riparian/wetland vegetation to the extent possible.

4. Address the effect of extensive recharge activities on the baseflow of the stream and the channel capacity for potential increased flows.

5. Develop long term operation and maintenance procedures in order to meet the specified objectives (see the Hydromod Planning Process).

Concerns: There must be an existing, valid water right when changing direction or quantity of a ground water supply (Utah Code Annotated, Sections 73-3-3 and 73-3-8). Changes in groundwater level and flow direction as the result of withdrawal/recharge activities can result in pollution problems to the stream/ground water regime by changing the pollutant gradient. Most recharge activities are classified as point sources. These activities are regulated by the Groundwater Discharge Permit Program and Underground Injection Control programs of the State Department of Environmental Quality, Groundwater Protection Section (Utah Administrative Code, R317-6, et. seq.). When the withdrawal/recharge activity is significant enough to alter the flow regime of the stream or allow intrusion of

pollutants into an aquifer, the activity will also be classified as a nonpoint source hydrologic modification. Prior to implementation of withdrawal/recharge activities, extensive groundwater investigations may be necessary to assure that there will be no undesirable short-term or long-range effects resulting from the expected maximum zone of influence.

Examples of BMP specifications:

fishery and/or riparian vegetation maintenance flows (IIFR)
channel maintenance flows (CMFC)
pumping plant for water control (SCS-#533)
infiltration gallery, trenches, basins (EPA-1992,Urban BMPs)
waterspreading (SCS-#640)
wells (SCS-#642) (CRVS) (AEPT)

References:

IIFR - Tennant, D.L. 1976. In-stream Flow Regimes for Fish, Wildlife, Recreation and Related Environmental Resources. *in:* Osborn, J.F. and C.H. Allman (editors). Proceedings of the Symposium on In-stream Flow Needs. Western Division of American Fisheries Society. Volume II. 657 pp.

CMFC - Rosgen, D.L., H.L. Silvey and J. P. Potyondy. 1986. The Use of Channel Maintenance Flow Concepts in the Forest Service. Hydrological Science and Technology: Short Papers. Vol. 2., No. 1, p. 19-26.

SCS-# - USDA Soil Conservation Service. Field Office Technical Guide. Practice #

CRVS -U.S. Department of the Interior, United States Geological Survey. 1968. Computation of Rate and Volume of Stream Depletion by Wells. Techniques of Water-Resource Investigations. Book 4, Chapter D1. Washington, D.C.

AEPT - Kruseman, G.P. and De Ridder, N.A. 1979. Analysis and Evaluation of Pumping Test Data. International Institute for Land Reclamation and Improvement. ISBN:90-702-60-360.

CHANNEL REALIGNMENT

Definition: Standards for straightening, restoring, or relocating a stream channel.

Objective: To ensure appropriate river function, flood capacity, sediment transmission, and biological integrity, and to minimize detrimental effects from channel realignments. To protect water quality and related aquatic wildlife habitat during and after the realignment has been implemented.

Condition where practice applies: Where appropriate planning processes (see the Hydromod Planning Process) have determined that channel realignment is necessary to accommodate development, reclaim riverine areas, or to remove the stream from problematic locations.

BMP application standards:

1. It is necessary to protect water quality and beneficial uses when straightening, restoring, or relocating a stream channel and when maintaining the associated structures. Apply the Hydromod Planning Process in planning and developing channel realignments. The Measures to Control Construction Activities BMP should be applied in implementing and constructing channel realignments. Refer to other BMPs that may apply (i.e., Grade Control, In-Stream Structures, Stream Crossings, or Bank Stabilization). Persons implementing these activities remain responsible for adhering to applicable laws, rules and regulations.

2. Sufficient hydrologic investigation should be done to determine the appropriateness of the new channel configuration. Data on channel width, depth, slope, sinuosity, bed materials, flow regime and velocity, floodplain width, soils and geology, and sediment yield and transport should be obtained and utilized.

3. Every effort should be made to retain as many natural functions of the river as possible in its new configuration including those provided by stream-side vegetation.

4. With streams supporting a fishery, realignments should not interfere with fish migration.

5. Develop long term operation and maintenance procedures in order to meet the specified objectives (see the Hydromod Planning Process).

Concerns:

As a general rule, channel straightening **is not** recommended. Benefits gained by the activity must definitely exceed the value lost in both the monetary resources needed to ensure a stable configuration of the stream, and the loss of less tangible values (such as the aquatic habitat impact and stream function).

An understanding of sediment transmission, channel hydraulics, and stream dynamics is necessary for the successful completion of channel realignments. Consultation with a professional engineer or hydrologist who understands stream geomorphology is highly recommended. Technical assistance may be available from the Soil Conservation Service, the Utah Department of Agriculture, the Utah Division of Wildlife Resources, or the Utah Division of Water Rights.

Channel realignments which approximate natural river conditions and functions as closely as possible are the ones most likely to succeed. This is because unforeseen complications are avoided and aquatic habitat parameters are better protected.

Channel realignments constitute stream alterations. Stream alteration activities require a stream alteration permit obtained from the Utah Division of Water Rights. Other permits may be necessary and must be obtained before proceeding.

Examples of BMP specifications:

channel relocation (UWR-9.1)
meander reconstruction (sinuosity restoration) (BCR-p234)
stream renovation (BCR-p227)
channel straightening (JRSS) (BCR-p28)
channel realignment (BCR-p28&p193)

References:

UWR - State of Utah, Administrative rules for Stream Channel Alterations, Division of Water Rights, Robert Morgan, P.E. State Engineer. Reprinted 1991. State Archives No. 8858.

BCR - Brookes, A. 1988. Channelized Rivers, Perspectives for Environmental Management. John Wiley and Sons.

JRSS - CH_2M-Hill. 1992. Jordan River Stability Study. Prepared for Salt Lake County.

GRADE CONTROL

Definition: Standards for the design and placement of structures to reduce excess stream power.

Objective: To stabilize a degrading stream channel without adversely effecting stream function and stability outside the treatment reach. To protect water quality and related aquatic wildlife habitat during and after the grade controls have been placed.

Conditions where practices applies: In degrading channels that are undergoing headcutting or problems from local scour, and where grade and stream velocity must be managed to encourage channel stability.

BMP application standards: Channel downcutting can be the result of high runoff events, loss of streamside vegetation, advancing valley scarps (Harvey, et. al., 1985), and loss of meanders with the subsequent steepening of channel grade (Berger, 1991). Grade control structures that are placed to treat a degrading stream reach can become the source of additional adverse channel adjustments both upstream and downstream. These adjustments often include accelerated stream aggradation, lateral migration, bank erosion, sedimentation, and loss of stream habitat (Rosgen and Fittante, 1986). Grade controls often reduce local upstream slope. The width/depth ratio increases, and the stream responds with lateral adjustment (Rosgen, 1993). Design of grade control must accommodate these geomorphic processes.

Grade control structures should be installed in combination with other practices to best protect the stream and its associated resources. This combination of BMPs as a resource management system (RMS) should stabilize the channel and direct the stream flow (USEPA, 1993), as well as include an appropriate mix of streambank protection (Bank Stabilization BMP), levee protection if necessary (Flood Control BMP), vegetative cover and management (Riparian Modification BMP), and terrace and meander reconstruction (Riparian Modification BMP). The planning process should also investigate watershed activities that may be contributing to the problem.

1. It is necessary to protect water quality and beneficial uses when placing and maintaining to reduce excess stream power. Apply the Hydromod Planning Process in planning grade control structures. The Measures to Control Construction Activities BMP should be applied in constructing grade control structures. Persons implementing these activities remain responsible for adhering to applicable laws, rules and regulations.

2. It is important to rectify any and all factors contributing to the degradation of the channel bed in order to maximize grade control efforts. Structural alternatives can often be minimized or even eliminated if a healthy watershed condition can be maintained (Rosgen, 1993).

3. Grade control practices must be appropriate for the stream type. Conduct a baseline hydrologic investigation to determine the appropriateness of design and location of any structures. Consultation with a professional engineer or hydrologist familiar with stream dynamics and geomorphology is recommended.

4. Structures must be substantially keyed into the streambanks and installed to a depth below maximum expected bed scour to prevent loss of structure to erosional undercutting. Scour below the structure should be anticipated and managed with appropriate armoring or other stabilizing treatment.

5. Grade control structures are primarily successful in first and second order streams (especially ephemeral streams). Structure height should be less than 1/5 to 1/2 the bankfull depth to allow the stream to utilize the floodplain effectively and minimize backwater effects and aggradation upstream.

6. Multiple check dams may be required for adequate control. General guidance suggests installation at each 2-3 channel widths. Controls should be located in riffles or in runs or upstream and downstream locations of channel bends (i.e., @ head and tail of pool).

7. Grade control structures must be designed to provide fish passage in streams with a fishery resource.

8. Riparian vegetation should generally be planted and managed in association with any grade control project. Consider transplanting rooted native material where it is available.

9. Develop long term operation and maintenance procedures in order to meet the specified objectives (see the Hydromod Planning Process).

Concerns: A thorough understanding of the causes of the channel degradation, stream dynamics and stream type is necessary in planning and implementing grade control projects. Check dams and drop structures must be appropriate for the stream type and generally incorporated with aggressive revegetation efforts. Grade control structures often result in adverse channel adjustments beyond the project area. These adjustments may require frequent and expensive maintenance and can result in impaired water quality and habitat values. A Stream Alteration Permit, issued by the Utah Division of Water Rights, is required for projects within the stream channel. Grade control projects must comply with all federal, state, and local regulations.

Examples of BMP specifications:

drop structures (UWR-9.5) (FRM-p.545) (JRNM)
grade stabilization structures (SCS-#410) (JRSS)
control of in-channel excavation (USFS-15.13)
stream channel stabilization (SCS-#584)
structure for water control (SCS-#587-1)
vortex weir (VRWD)

References:

UWR - State of Utah, Administrative rules for Stream Channel Alterations, Division of Water Rights, Robert Morgan, P.E. State Engineer. Reprinted 1991. State Archives No. 8858.

FRM - Meehan, W.R. 1991. Influences of Forest and Rangeland Management on Salmonid Fishes and Their Habitats. American Fisheries Society Special Publication 19. Bethesda, Maryland.

JRNM - Jensen, S.F. 1988. Jordan River Nonpoint Source Management Plan. Salt Lake City-County Health Department.

SCS-# - USDA Soil Conservation Service. Field Office Technical Guide. Practice #

JRSS - CH_2M-Hill. 1992. Jordan River Stability Study. Prepared for Salt Lake County.

USFS - USDA Forest Service, Region 4, 1988. Soil and Water Conservation Practices Handbook. Ogden, Utah. Forest Service Handbook 2509.22

VRWD -Rosgen, D.L 1993. Vortex Rock Weir Design. Short Course on Stream Classification and Applications. Utah State University, May 1993. *From*: 1991 Implementation of the Vortex Rock Weir Design in Colorado, California, and Maryland streams. Wildland Hydrology Consultants, Pagosa Springs, Colorado.

WWDS Rosgen, D.L. 1993. WWeir Design. Short Course on Stream Classification and Applications. Class notes, Utah State University, May 1993.

IN-STREAM STRUCTURES

Definition: Standards for the placement of material within an active channel as part or all of a diversion, checkdam, deflector, bridge abutment, bridge, or other piling, or other structure that reduces channel capacity, causes upstream back-watering or eddying, affects the downstream flow configuration, or causes the river to adjust its bankfull channel.

Objective: To protect water quality and related aquatic wildlife habitat during and after the in-stream structure is placed. To ensure that in-stream structures do not adversely effect the configuration and function of the bankfull channel in providing flow and sediment transmission, especially during bankfull flow, or to ensure that such adverse effects are identified and appropriately mitigated.

Conditions where practice applies: The practice applies whenever the placement of materials causes the stream to adjust its bankfull channel. In situations where the bankfull channel is not known, the apparent active channel (below the point on the streambanks where flow extends into an obvious floodplain that is utilized less often than once in three years on the average) will be considered bankfull.

BMP application standards:

1. It is necessary to protect water quality and beneficial uses during the placement, operation, and maintenance of in-stream structures. Apply the Hydromod Planning Process in planning and developing in-stream structures. Apply the Measures to Control Construction Activities BMP in implementing and constructing in-stream structures. Persons implementing these activities remain responsible for adhering to applicable laws, rules and regulations.

2. Sufficient hydrologic investigation should be done to determine the appropriateness of design and placement of any structures. Data on channel width, depth, slope, sinuosity, bed materials, flow regime and velocity, floodplain width, soils and geology, and sediment yield and transport should be obtained.

3. All structures should be keyed sufficiently into the streambanks and into the channel bed to reduce the possibility of erosion under, around, or through the structure. Special attention should be paid to the structures integrity during the 25-yr flood event or for a higher return interval flood as specified by the land owner, manager or by the design agency. The design event should be determined by structure use, by public safety considerations, and acceptable risk probabilities.

4. Apply the Bank Stabilization BMP upstream and downstream of the structure when back-watering, eddying, or flow redirection causes erosion or sediment deposition with attendant lateral stream migration and erosion.

5. Apply the Grade Control BMP when the structure causes downcutting in the channel bottom.

6. Make provisions that accommodate or mitigate natural meander migration by the river system.

7. In streams supporting a fishery, design and place all structures so as to not interfere with fish migration.

8. Develop long term operation and maintenance procedures in order to meet the specified objectives (see the Hydromod Planning Process).

Concerns: An understanding of open channel hydraulics and stream dynamics is necessary for the successful building or upgrading of in-stream structures. Consultation with a professional engineer or hydrologist who understands stream geomorphology is highly recommended. Technical assistance may be available from the Soil Conservation Service, the Utah Department of Agriculture, the Utah Division of Wildlife Resources, or the Utah Division of Water Rights.

The building or upgrading of in-stream structures constitutes a stream alteration. Stream alteration activities require a stream alteration permit obtained from the Utah Division of Water Rights.

Examples of BMP specifications:

diversion and water control structures (UWR-9.8) (SCS-#348&587)
sediment control basins (SCS-#350)
flood retarding dam (SCS-#402)
grade and channel stabilization structures (SCS-#410&584) (UWR-9.5)
miscellaneous in-stream structures (SCS-#533) (WMT-B3) (FRMp529&547) (FHS)
braid block (SHI)
bridges and culverts (USFS-15.16), WMT (C2&3), FRM (p312-323)
open channels (SCS-#582) (BCR-p29)
infiltration gallery
stream channel protection (USFS-14.17)

References:

UWR - State of Utah, Administrative rules for Stream Channel Alterations, Division of Water Rights, Robert Morgan, P.E. State Engineer. Reprinted 1991. State Archives No. 8858.

SCS-# - USDA Soil Conservation Service. Field Office Technical Guide. Practice #

WMT - Musclow, H.J., and L.B. Dalton. 1990. Wildlife Mitigation Technologies for Man-Made Impacts. Utah Department of Natural Resources, Division of Wildlife Resources. Publication Number 90-3.

FRM - Meehan, W.R. 1991 Influences of Forest and Rangeland Management on Salmonid Fishes and Their Habitats. American Fisheries Society, Special Publication 19. Bethesda, Maryland.

FHS - Rosgen, D. and B.L. Fittante. 1986. Fish Habitat Structures -- A Selection Guide Using Stream Classification. pp 163-179 in Miller, et al. 1986. Proceedings, 5th Trout Stream Habitat Improvement Workshop. Pennsylvania Fish Commission, Harrisburg.

SHI - U.S. Forest Service. 1992. Stream Habitat Improvement Handbook. Technical Publication R8-TP 16.

USFS - USDA Forest Service, Region 4, 1988. Soil and Water Conservation Practices Handbook. Ogden, Utah. Forest Service Handbook 2509.22

BCR - Brookes, A. 1988. Channelized Rivers, Perspectives for Environmental Management. John Wiley and Sons.

USFS - USDA Forest Service, Region 4, 1988. Soil and Water Conservation Practices Handbook. Ogden, Utah. Forest Service Handbook 2509.22

STREAM CROSSINGS

Definition: Standards for placing stream crossing structures and facilities in order to protect the stream and its beneficial uses from nonpoint sources of pollution or other adverse effects.

Objective: To enable installation and maintenance of stream crossing structures that do not significantly cause erosive velocities, unnecessary sedimentation or turbidity, or flooding; alter flow patterns; damage streams or channels; or obstruct fish passage. To protect water quality and related aquatic wildlife habitat during and after the stream crossing has been developed and during its use.

Conditions where practice applies: Practices apply to all permanent or temporary road crossings, bridges, culverts, low-water crossings and fords, and utility crossings through any stream channel.

BMP application standards: It is necessary to protect water quality and beneficial uses during the placement, use, and maintenance of stream crossings. The number of crossings shall be kept to the minimum needed for access or efficient routing. Location, design criteria, and protective measures should be developed by an inter-disciplinary team considering stream type and geomorphological character, riparian and vegetative characteristics, stream flow regimen, and hydraulics, and local and downstream beneficial uses of the water.

The Hydromod Planning Process and the Measures to Control Construction Activities BMPs shall be applied in the design and development of all crossing structures involving stream courses. Persons implementing these activities remain responsible for adhering to applicable laws, rules and regulations.

Concerns: The development of a stream crossing constitutes a stream alteration. Stream alteration activities require a stream alteration permit obtained from the Utah Division of Water Rights. Other permits may be necessary and must be obtained before proceeding.

Structures shall be designed to avoid obstruction of the stream course, including the flood plain. Fill will be stabilized and kept to a minimum. Preventative measures include:

1. Divert stream flow around project sites during construction in order to minimize erosion and downstream sedimentation.

2. Deposit erodible materials well away from the stream channel.

3. Remove any material stockpiled on floodplains in order that rising waters will not reach them.

4. During excavation in or near the stream course, it may be necessary to use suitable coffer dams, caissons, cribs, or sheet piling. This will usually be the case where groundwater is contributing a significant amount of water to the immediate excavation area. If pumping is used to remove water, discharge to the stream must be clear water by using settling ponds.

5. Construction activities in or adjacent to streams will be limited to specific times to protect beneficial water uses. Construction periods shall be as short as practicable.

6. Install culverts or pipe arches across small streams to conform to the natural stream bed and slope on streams that support fish or seasonal fish passage.

7. Place culverts slightly below normal stream grade to avoid culvert outfall barriers. Do not alter stream channels upstream from culverts, unless necessary to protect fill or to prevent culvert blockage.

8. Install culverts to prevent erosion of fill. Compact the fill material to prevent seepage or failure. Armor the inlet and/or outlet with rock or other suitable material where needed.

9. Align structures perpendicular to stream flow.

10. Develop long term operation and maintenance procedures in order to meet the specified objectives (see the Hydromod Planning Process).

Examples of BMP specifications:

crossing placement (WMT-C1)
bridge and culvert installation (USFS-15.16)
culverts (UWR-9.7) (WMT-C2) (FRM-p312-323)
bridges (UWR-9.7) (WMT-C3)
piers (UWR-9.8)
below channel pipelines and utility crossings (UWR-9.9)
above channel pipelines and utility crossings (UWR-9.10)
stream crossings on temporary roads (USFS-15.15)
fords (WMT-C4)
bridge monitoring and inspection (JRSS)

References:

WMT - Musclow, H.J., and L.B. Dalton. 1990. Wildlife Mitigation Technologies for Man-Made Impacts. Utah Department of Natural Resources, Division of Wildlife Resources. Publication Number 90-3.

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FRM - Meehan, W.R. 1991 Influences of Forest and Rangeland Management on Salmonid Fishes and Their Habitats. American Fisheries Society, Special Publication 19. Bethesda, Maryland.

JRSS - CH_2M-Hill. 1992. Jordan River Stability Study. Prepared for Salt Lake County.

EO 11988, Flood Plain Management.

Forest Service Handbook FSH 7709, Transportation Engineering Handbook.

BANK STABILIZATION

Definition: Standards for using vegetation or structures to stabilize and protect channel banks against scour and erosion. Practices in this category are designed to prevent or control lateral adjustment or migration of stream channels.

Objective: To stabilize or protect streambanks for one or more of the following purposes, in a manner that will minimize adverse impacts:

1. to reduce sediment loads causing downstream damages and pollution;
2. to prevent loss of land or damage to utilities, roads, buildings, or other facilities adjacent to stream banks;
3. to improve the stream for fish habitat or recreation;
4. to maintain channel capacity; and
5. to protect water quality and related aquatic wildlife habitat during and after the bank has been stabilized.

Conditions where practice applies: Practices in this category apply to stream channels with eroding streambanks.

BMP application standards:

1. It is necessary to protect water quality and beneficial uses during the placement and maintenance of bank stabilization. Apply the Hydromod Planning Process in the planning of bank stabilization measures. Apply the Measures to Control Construction Activities BMP in implementing and constructing bank stabilization. Persons implementing these activities remain responsible for adhering to applicable laws, rules and regulations.

2. Ensure that measures or practices selected to stabilize banks are suitable for the stream type.

3. Consider structural measures only after an evaluation by an interdisciplinary team of the amount of stabilization that can feasibly be achieved by vegetative protection and measures to manage land uses.

4. Avoid changes in channel alignment except where such changes will result in a more stable channel condition. Make channel alignment changes only after an interdisciplinary evaluation of effects on channel stability, streamflow characteristics, and fluvial processes (see the Channel Realignment BMP).

5. Structural protection should be constructed to a depth well below the anticipated lowest depth of bottom scour.

6. Vegetative protection should be used on upper parts of the bank above normal bankfull height.

7. Streambank protection shall be started at a stable or controlled point and ended at a stable or controlled point on the channel bank.

8. Measures and practices should be selected to achieve bank stabilization that:
    a. are visually pleasing;
    b. also provide fish and wildlife habitat; and
    c. provide adequate bank roughness to avoid flow velocities greater than would occur under natural bank conditions.

9. All materials, placement and construction will be done according to acceptable standards and specifications for the measure or practice selected.

10. Develop long term operation and maintenance procedures in order to meet the specified objectives (see the Hydromod Planning Process).

Concerns: Bank stabilization activities for the most part constitute stream alterations. Stream alteration activities require a stream alteration permit obtained from the Utah Division of Water Rights. Other permits may be necessary and must be obtained before proceeding.

Poorly designed and implemented bank stabilization measures have the potential to cause increased bank and channel erosion by changing flow velocities and distribution, obstructing channel capacity, and restricting the stream's access to its floodplain. Improperly planned, designed or placed structural measures can also be visually unpleasing and cause loss of fish habitat.

Examples of BMP specifications:

dumped rock riprap (UWR-9.4.1) (WMT-B4) (JRSS) (BCR-p34)
riprap slope toe only (JRNM)
riprap with topsoil and vegetation (BCR-p214)
gabions (UMR-9.4.2) (WMT-B4) (JRSS)
soil cement (JRSS)
conifer revetment (WMT-B4)
vegetation enhancement (WMT-B4&J1-J7) (BCR-34)
channel vegetation (SCS-#322)
streambank protection (USFS-15.19) (SCS-#580)
jetties (UWR-9.4.4)
deflectors (WMT-B5)

References:

UWR - State of Utah, Administrative rules for Stream Channel Alterations, Division of Water Rights, Robert Morgan, P.E. State Engineer. Reprinted 1991. State Archives No. 8858.

WMT - Musclow, H.J., and L.B. Dalton. 1990. Wildlife Mitigation Technologies for Man-Made Impacts. Utah Department of Natural Resources, Division of Wildlife Resources. Publication Number 90-3.

JRSS - CH_2M-Hill. 1992. Jordan River Stability Study. Prepared for Salt Lake County.

BCR - Brookes, A. 1988. Channelized Rivers, Perspectives for Environmental Management. John Wiley and Sons.

JRNM - Jensen, S.F. 1988. Jordan River Nonpoint Source Management Plan. Salt Lake City-County Health Department.

SCS-# - USDA Soil Conservation Service. Field Office Technical Guide. Practice #

USFS - USDA Forest Service, Region 4, 1988. Soil and Water Conservation Practices Handbook. Ogden, Utah. Forest Service Handbook 2509.22

CHANNEL/FLOODPLAIN EXTRACTION OR REWORKING

Definition: Standards for the extraction or reworking of materials in stream channels or floodplains. Extraction involves mining of streambed or bank materials to extract gravel, cobbles, or other materials. Reworking materials involves excavation or dredging streambed and/or bank material to extract minerals or a fraction of the soil material.

Objective: To ensure continued appropriate function, flood capacity, sediment transmission, and biological integrity of the stream channel or floodplain. To protect water quality and related aquatic wildlife habitat during and after the extraction or reworking takes place.

Conditions where practice applies: Any channel where the bed and/or bank material is suitable for construction, or where bed and bank materials contain precious minerals.

BMP application standards:

1. It is necessary to protect water quality and beneficial uses during the placement, operation, and maintenance of equipment, materials and structures associated with these activities. Apply the Hydromod Planning Process in planning these activities. Apply the Measures to Control Construction Activities BMP while performing these activities. Persons implementing these activities remain responsible for adhering to applicable laws, rules and regulations.

2. Large mining operations significantly impact the natural stream environment, water quality, bank and channel stability, and aquatic wildlife. Careful evaluation of the drainage is required to determine the existing values of the riverine system and the impact the project will impose on the system. The values and/or impact may be significant enough to deny the project.

3. The stream type and erosion deposition balance must be considered. Mining activity is less impacting to aggrading and/or braided systems then to stable or degrading systems.

4. Excavation below the streambed elevation should be avoided. Deep excavation can cause headcut migration and channel degradation.

5. Disturbance to riparian vegetation must be minimized or preferably avoided. Riparian vegetation greatly reduces streambank erosion.

6. Areas disturbed by mining, particularly the bed and banks, may be more susceptible to erosion which may result in an increase in both bedload and suspended material. Measures should be taken to minimize erodibility. Procedures could include (but are not limited to):

    a. grade control;
    b. geomorphic reconstruction;
    c. bank stabilization;
    d. collecting gravel in an off-channel site;
    e. removal of spoil piles from channel area;
    f. replacing armoring; and/or
    g. vegetative reclamation.

7. Extraction of material shall be conducted in such a manner that the return water from the dredge does not significantly increase the turbidity of the stream below the operation.

8. Disturbance of graveled spawning areas at the tail of pools shall be avoided. This includes the discharge of fine material which deposits on the gravel beds.

9. No petroleum products, refuse, or other deleterious material shall be allowed to fall, be washed into, or deposited in or near surface water.

10. Significant changes to channel geometry, channel type and/or condition should require reclamation of the channel and riparian zone.

11. Work shall be timed to avoid spawning periods in streams where fisheries exist.

12. Develop long term operation and maintenance procedures in order to meet the specified objectives (see the Hydromod Planning Process).

Concerns: Extracting material from a channel may have serious results including changes in:

1. Geomorphic channel type
2. Sediment transport capabilities
3. Sediment load
4. Streambed elevation
5. Erodibility
6. Stability
7. Riparian vegetation and
8. Water quality

A Stream Alteration Permit or Recreational Gold Dredging permit is required for these activities.

Examples of BMP specifications:

gravel mining
mining for gold within or along channels.
gravel bar removal (UWR-9.2)
clearing and snagging (SCS-#326)

References:

UWR - State of Utah, Administrative rules for Stream Channel Alterations, Division of Water Rights, Robert Morgan, P.E. State Engineer. Reprinted 1991. State Archives No. 8858.

SCS-# - USDA Soil Conservation Service. Field Office Technical Guide. Practice #

FISH HABITAT ENHANCEMENT

Definition: Standards for placing structures or practices to enhance fish habitat.

Objective: To ensure habitat improvements are successful and that they do not degrade water quality or channel conditions during and after the enhancements have been placed.

Condition where practice applies: Surface waters where lack of habitat is limiting fish production; enhancements are often used as mitigation for projects that degrade or destroy a natural habitat.

BMP application standards:

1. It is necessary to protect water quality and beneficial uses during the placement, operation, and maintenance of equipment, materials and structures associated with these activities. Apply the Hydromod Planning Process in planning and developing fish habitat enhancements. Apply the Measures to Control Construction Activities BMP in implementing and constructing fish habitat enhancements. The Instream Structures BMP and other BMPs may also apply. Persons implementing these activities remain responsible for adhering to applicable laws, rules and regulations.

2. Factors causing degraded habitat conditions must be addressed before contemplating habitat improvements.

3. An evaluation of existing habitat conditions must be made prior to designing habitat enhancements. Factors limiting fish production must be identified. An accepted fish habitat evaluation procedure such as the Habitat Quality Index (Binns, 1982), Habitat Evaluation Procedure (U.S. Fish and Wildlife Service), or Instream Flow Incremental Methodology (U.S. Fish and Wildlife Service), should be used.

4. Appropriateness of the structure for the channel type, predicted changes in hydraulics, and predicted use by fish should be evaluated prior to construction. Whenever possible, a fisheries biologist, a hydrologist, and geomorphologist should all be consulted for approval of the project design.

5. Develop long term operation and maintenance procedures in order to meet the specified objectives (see the Hydromod Planning Process).

Concerns: Projects will not be successful if the factors causing degradation are not removed prior to implementing habitat improvements. Poorly designed or implemented fish habitat improvement projects have the potential to do more harm than good by de-stabilizing stream channels. Projects will not be successful if their effect on erosion and deposition are not considered. A stream alteration permit is required for most habitat enhancement projects. Other federal, state, or local laws may apply.

Examples of BMP specifications:

fish stream improvement (SCS-#395) (FHS) (SHI)
resting area development (WMT-B6&B8) (FRM-p544-547) (FHS)
spawning habitat improvement (WMT-B8) (FRM-p526-528) (FHS)
migration barriers (FHS) (SHI)
habitat improvement dams (FHS)
deflectors, barbs, jetties (FHS) (SHI)
shelters, log cover (FHS) (SHI)
overhanging bank vegetation
blasting to create pools

References:

SCS-# - USDA Soil Conservation Service. Field Office Technical Guide. Practice #

FHS - Rosgen, D. and B.L. Fittante. 1986. Fish Habitat Structures -- A Selection Guide Using Stream Classification. pp 163-179 in Miller, et al. 1986. Proceedings, 5th Trout Stream Habitat Improvement Workshop. Pennsylvania Fish Commission, Harrisburg.

SHI - U.S. Forest Service. 1992. Stream Habitat Improvement Handbook. Technical Publication R8-TP 16.

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FRM - Meehan, W.R. 1991 Influences of Forest and Rangeland Management on Salmonid Fishes and Their Habitats. American Fisheries Society, Special Publication 19. Bethesda, Maryland.

Beschta, R.L., J. Griffith, T.A. Wesche. 1993. Field Review of Fish Habitat Improvement Projects in Central Idaho. U.S. Department of Energy. Bonneville Power Administration. Project Number 84-24; 83-359.

Binns, Allen N. 1982. Habitat Quality Index Procedures Manual. Wyoming Game and Fish Department.

Frissell, C.A., and R.K. Nawa. 1992. Incidence and Causes of Physical Failure of Artificial Habitat Structures in Streams of Western Oregon and Washington. North American Journal of Fisheries Management. 12:182-197.

U.S. Fish and Wildlife Service. Habitat Evaluation Procedure. National Ecology Research Center.

U.S. Fish and Wildlife Service. Instream Flow Incremental Methodology. National Ecology Center.

FLOOD CONTROL PRACTICES

Definition: Standards for activities to reduce the loss of life or property due to flooding.

Objective: To minimize detrimental effects to natural channels and their long-term function (through natural events such as floods) from flood control activities. To protect water quality and related aquatic wildlife habitat during and after the practices have been placed.

Conditions where practice applies: Areas containing valuable property which are prone to flooding.

BMP application standards:

1. It is necessary to protect water quality and beneficial uses during these activities as well as during the placement, operation, and maintenance of structures associated with these activities. Apply the Hydromod Planning Process in planning and developing flood control practices. Apply the Measures to Control Construction Activities BMP in implementing and constructing flood control practices. The Impoundments, Channel Realignment, or Bank Stabilization BMPs may apply. Persons implementing these activities remain responsible for adhering to applicable laws, rules and regulations.

2. Non-structural methods of floodplain protection should be pursued first, then out-of-channel methods. In-channel alterations should be used only as a last alternative.

3. The cross-sectional area of the natural channel, the channel slope, and the mean water velocity, should not be significantly increased or decreased.

4. Preserve or replant stream-side vegetation; preserve pools, riffles, and channel substrate.

5. The flood hazard, including depth, velocity, duration, and frequency, the value of the property to be protected, long-term maintenance costs, and the natural values affected, must be considered prior to undertaking a flood control project.

6. Provisions should be made to retain a sufficiently wide floodplain. If enough width is not possible, then channel stability should be enhanced. As the floodplain is constricted, vegetatively derived channel stability should be exploited as possible, then structural treatments applied if necessary.

7. Develop long term operation and maintenance procedures in order to meet the specified objectives (see the Hydromod Planning Process).

Concerns: In-channel structural flood control measures frequently result in unintended channel adjustments that require additional expensive maintenance, and most often result in severe degradation of water quality or aquatic and riparian habitat.

When using structural flood control practices, a stream alteration permit, 404 permit, and local flood control permit are probably required. Other federal, state, and local laws may also apply.

Examples of BMP specifications:

Non-structural:
- land-use planning (FAME&87&89) (JRSS)
- urban redevelopment & preservation (FAME)
- land acquisition in floodplain areas (FAME) (JRSS)
- flood-proofing (FAME)
- forecasting, warning & emergency preparedness (FAME) (NEWS)

Structural:
- flood-proof or retrofit flood-prone structures, including elevation, relocation, levee or flood-wall construction, closures, and sealants (FAME.b,&89)
- selective clearing and snagging (BCR-p201) (AFS)
- selective weed cutting (BCR-p203)
- dikes (SCS-#356) (BCR-p200)
- levees, embankments (BCR-p196)
- flood retarding dam (SCS-#402)
- floodwater diversion (SCS-#400)
- floodway (SCS-#404) (BCR-p240)
- two-stage channel (BCR-p222)
- channel enlargement by widening (BCR-p195)
- channel enlargement by deepening(BCR-p195)
- dredging (BCR-p203)
- channel realignment (BCRp-193)
- channel straightening (BCRp28&195)
- lined channels (BCRp-197)
- dams for floodwater retarding

References:

FEMA - Federal Emergency Management Agency. 1981. Design Guidelines for Flood Damage Reduction. Federal Emergency Management Agency 15. Washington, D.C.

FEMA,1985 - Federal Emergency Management Agency. 1985. Manufactured Home Installation in Flood Hazard Areas. Federal Emergency Management Agency 85. Washington, D.C.

FEMA,1986a - Federal Emergency Management Agency. 1986a. Flood-proofing Non-Residential Structures. Federal Emergency Management Agency 102. Washington, D.C.

FEMA,1986b - Federal Emergency Management Agency. 1986b. Retro-fitting Flood-prone Residential Structures. Federal Emergency Management Agency 114. Washington, D.C.

FEMA,1987 - Federal Emergency Management Agency. 1987. Reducing Losses in High Risk Flood Hazard Areas: A Guidebook for Local Officials. Federal Emergency Management Agency 116. Washington, D.C.

FEMA, 1989 - Federal Emergency Management Agency. 1989. Alluvial Fans: Hazards and Management. Federal Emergency Management Agency 165. Washington, D.C.

JRSS - CH_2M-Hill. 1992. Jordan River Stability Study. Prepared for Salt Lake County.

NWS - National Weather Service. 1981. Automated Local Evaluation in Real Time: A Cooperative Flood Warning System for Your Community. Salt Lake City, Utah.

AFS - American Fisheries Society. 1983. Stream Obstruction Removal Guidelines. Bethesda, MD.

BCR - Brookes, A. 1988. Channelized Rivers, Perspectives for Environmental Management. John Wiley and Sons.

SCS-# - USDA Soil Conservation Service. Field Office Technical Guide. Practice #

RIPARIAN/FLOODPLAIN MODIFICATION

Definition: Standards for using vegetation, structures and/or management practices to restore and protect riparian areas and floodplains and to maintain their appropriate hydrologic functions.

Objective: To restore, protect, or maintain riparian areas and floodplains, and to minimize the adverse effect of actions that alter or modify riparian areas and floodplains. To protect water quality and related aquatic wildlife habitat during and after the modifications have been placed.

Conditions where practice applies: Practices in this category apply to riparian areas and floodplains.

BMP application standards:

1. It is necessary to protect water quality and beneficial uses during these activities as well as during the placement, operation, and maintenance of materials, equipment and structures associated with these activities. Apply the Hydromod Planning Process in the planning of modifications to the floodplain or riparian area. Apply the Measures to Control Construction Activities BMP with construction activities or modifications in riparian or floodplain areas. Persons implementing these activities remain responsible for adhering to applicable laws, rules and regulations.

2. Sufficient hydrologic investigation should be done to determine the appropriateness of design and placement of any structures in the floodplain.

3. Measures or practices selected to achieve riparian modification should be suitable for the riparian site and stream type, as determined by an appropriate interdisciplinary team.

4. Access of a stream to it's floodplain should not be restricted unless it is determined that the loss of appropriate stream function and the associated values is warranted and unless substantial stabilization and other measures to mitigate losses to the system are implemented.

5. Structural measures, such as fences or barriers, may be used to facilitate proper protection and use of streamside areas. These must be maintained to function properly.

6. Measures and practices should be selected to achieve riparian modifications that:
    a. are visually pleasing;
    b. provide fish and wildlife habitat;
    c. allow floodplains and riparian areas to function properly.

7. Uses of the area will be managed to protected riparian vegetation from damage and maintained a condition or state consistent with the objective of this BMP.

8. All measures and practices used to achieve riparian modification will be implemented according to acceptable standards and specifications for the measure or practice selected.

9. Develop long term operation and maintenance procedures in order to meet the specified objectives (see the Hydromod Planning Process).

Concerns: Structures and activities that limit a stream's access to its floodplain or decrease protective riparian vegetation can cause instability of stream banks, increased flooding, and degraded water quality.

If an activity will alter the bed or banks of a natural stream channel, a stream alteration permit from the Utah Division of Water Rights is required.

Examples of BMP specifications:

proper herbicide use in association with vegetation management
riparian area designation (USFS-14.06)
control of road construction in riparian areas (USFS-15.03&15.12)
location and design of roads and trails (USFS-15.02) (WMT-G1) (FRM-p303)
meander corridor protection (JRSS-1992)
tree planting (SCS-#162)
critical area planting (SCS-#342)
channel vegetation (SCS-#322)

References:

USFS - USDA Forest Service, Region 4, 1988. Soil and Water Conservation Practices Handbook. Ogden, Utah. Forest Service Handbook 2509.22

WMT - Musclow, H.J., and L.B. Dalton. 1990. Wildlife Mitigation Technologies for Man-Made Impacts. Utah Department of Natural Resources, Division of Wildlife Resources. Publication Number 90-3.

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JRSS - CH_2M-Hill. 1992. Jordan River Stability Study. Prepared for Salt Lake County.

SCS-# - USDA Soil Conservation Service. Field Office Technical Guide. Practice #

WETLAND ENHANCEMENT

Definition: Standards for placing structures and implementing practices that create, restore, or enhance wetlands.

Objective: To successfully create, restore, or enhance wetlands for groundwater recharge, commercial products, base flow augmentation, recreation, education, flood reduction, research, aesthetics, water purification, wildlife habitat, and bank stabilization or protection. To protect water quality and related aquatic wildlife habitat during and after wetland enhancement.

Conditions where practice applies: This practice applies to sites that were natural wetlands which were drained, and to sites that are capable of storing water for the development of a wetland facility; it includes structural and nonstructural facilities and practices.

BMP application standards:

1. It is necessary to protect water quality and beneficial uses during these activities as well as during the placement, operation, and maintenance of materials, equipment and structures associated with these activities. The Hydromod Planning Process should be applied in developing wetland enhancements. The Measures to Control Construction Activities BMP should be applied in implementing and constructing wetland enhancements. Persons implementing these activities remain responsible for adhering to applicable laws, rules and regulations.

2. Clearly define wetland objectives and which functional values are desired prior to proceeding with design and implementation.

3. Wetland site selection and evaluation must consider land ownership, use, and availability; water rights; topography; geology; hydrology; soil; climate and weather; biology; and regulations.

4. Provisions must be made to actively manage hydrology (at least until desired vegetation is established), and to perform routine monitoring and maintenance of structures and vegetation. Maintenance may include control of woody species or tunneling animals on dikes; controlled burning of vegetation to maintain a preferred successional stage; and weed control.

5. Select plant material from locally adapted sources when possible.

6. Develop long term operation and maintenance procedures in order to meet the specified objectives (see the Hydromod Planning Process).

Concerns: Some wetland enhancement activities may require an existing, valid water right. Wetland creation failures are most often attributed to lack of adequate consideration of hydrology, and/or the lack of adequate care in the first few years of establishment. Possible negative impacts to downstream users from alterations in hydrology must be evaluated. Modification of an existing wetland requires a 404 permit. Other federal, state, or local laws may apply.

Examples of BMP specifications:

wetland development or restoration (SCS-#657)
wildlife habitat management (SCS-#644)
wetland reclamation via destruction of drainage facilities (CFW)
sealing and lining (CFW-p165-166)
dikes, dams, or berms (SCS-#356) (CFW-p167)
water control structures such as stoplogs, flashboards, culverts, swivel pipes, or valves (SCS-#587) (CFW-p167-178)
emergency spillway (SCSAH-#590)
revegetate (CFW-p195-226)

References:

SCS-# - USDA Soil Conservation Service. Field Office Technical Guide. Practice #

CFW - Hammer, D.A. 1992. Creating Freshwater Wetlands. Lewis Publishers. Chelsea, MI.

SCSAH-# - U.S. Soil Conservation Service Agricultural Handbook No. 590. Ponds -- Planning, Design, Construction.

Kusler, J.A., and G. Brooks. 1987. Proceedings of the National Wetland Symposium: Wetland Hydrology. September 16-18, 1987. Chicago, Illinois. Association of State Wetland Managers, Box 2463, Berne, NY 12023.

Kusler, J.A. and M.E. Kentula. 1990. Wetland Creation and Restoration: The Status of the Science. Island Press, Washington, D.C.

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Appendix C